Feb 9th 2024,

Prof. Danilo Demarchi

Editor in Chief

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Dear Prof. Demarchi,

**Revision 2: TAFE-10-0063-2023**

I am pleased to send the revised manuscript for your consideration. Our responses and revisions made are listed below.

Best Regards

Sudath Rohan Munasinghe

(corresponding Author TAFE-10-0063-2023)

**Review comments and corresponding responses:**

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| **Associate Editor** | |
| **Comment 1:** Please emphasize well the scientific and technical novelty of the paper, which at the moment seems rather limited. | |
| **Response:** This research presents a scientifically engineered solution for fruit growers to improve accuracy and efficiency in fruit treatment and monitoring. The scientific merit of the work can be highlighted as follows:   1. The workers are deployed in groups of approximately six to ten. Workers in a group stay together and walk from tree to tree while treating fruits (bagging, spraying, plucking). They might miss one or few fruits for treating and also may attempt to treat (spray) an already treated fruit. The proposed method solves these issues by creating a local wifi network between the group members' hand devices and updating each worker's actions in real-time, hence re-treating and no-treating are completely and instantly avoided. If a worker tries to re-spray a mango, his hand device will immediately notify that the particular fruit has already been treated. If workers move to the next tree, leaving a fruit untreated in the present tree, the hand devices will notify the team that there is an untreated fruit in the preceding tree. The system allows to registration of fallen mangos and missing mangoes. 2. The short-range local wifi network between the group’s hand devices stores data and is used immediately for real-time operation, and when the connectivity to the mobile communication network is available, the stored data is sent to the cloud database. 3. The cloud server shows the real-time status and statistics of the fruits being treated. This allows the grower to timely intervene when the process goes out of schedule. 4. The system is designed for worker’s convenience and liking. The use of the new system increases the workers’ daily output and efficiency, hence their income. 5. The proposed solution is extremely cost-effective, and deployable in large-scale orchards where small worker groups are deployed for work.   The proposed method was devised by integrating several state-of-the-art technologies; (1) RFID technology, (2) Local Wi-Fi mesh network, (3) Mobile App, (4) Coud database/server, and (5) Web Application. The proper integration of these technologies to provide an effective and worker-friendly solution to the problem of interest cost-effectively is the merit of this research.  The abstract and introduction were revised highlighting the scientific/technological merit of the research.  More details of the hand device’s power system have been included in page 2, column 2, paragraph 2 | |
| **Reviewer 1** | |
| **Comment:** the pilot with only 20 mangos, which is hardly statistically significant | |
| **Response 1.1:** The fruit treatments are implemented by small worker groups of six to ten. A few such groups are deployed daily, and these groups operate independently. Hence, the proposed solution can be implemented independently of the orchard scale if it properly operates within a single worker group. Only the cloud server capacity and communication bandwidth need to be scaled based on the number of worker groups in concurrent operation. to be able to handle the parallel data coming from the worker groups concurrently. On the other hand, the worker group devices re-attempt and get the data uploaded to the server ubiquitously in situations of high data rates from the worker groups.  Therefore, we are confident that the outcome of the very small-scale field test provides a reasonable assurance about the performance of the proposed solution when applied across a larger orchard.  The pilot project was initially planned for 100 trees and 2000 mangos, but it had to be deferred considering the economic situation in Sri Lanka. As an alternative, this very small worker group scale field test was designed to test all the features of the system, including (1) the Mobile app and initial registration of trees and fruits (2) scheduling tasks, (3) monitoring treatments, (4) detecting fallen and missing fruits, (5) detecting untreated fruits, (6) detecting re-treatment attempts, (7) data storage and cloud upload, and (8) Cloud-based visualization.  We align with the reviewer's comment and understand that the word “pilot project” would be inappropriate for this scale of implementation. Hence the term “small-scale field test” is used in the revised manuscript.  **Revisions:**  Accordingly, the section title “IV PILOT PROJECT” was changed to “IV FIELD TEST”, in which necessary revisions were introduced in the first and second paragraphs. Fig. 8 was replaced with a 3D histogram representation which illustrates the fruit treatment process and field test results clearly.  A better clarification of the “scalability” has been included in the last paragraph in the “1. INTRODUCTION” | |
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| **Reviewer 2** |  |
| 1. the data provided as a result of the small-scale pilot project implementation is insufficient | Please refer to the **Response 1.1** above |
| 1. rewriting the description of the section "Fallen and Missing Fruits". This section could be improved by providing a direct explanation of the mechanism for the detection of missing and fallen fruits. Additionally, a table could be added to show the number of detected missing and fallen fruits during each spraying/scan. This would help readers better understand the process and results of the study. | The section was revised accordingly. Now it presents the direct mechanism of registering missing and fallen fruits.  The new version of Fig. 8 also provides clear information about missing and fallen fruits. It shows that 3 fruits went missing and 1 fell off between Spray\_2 (40 days) and plucking (90 days). |
| 1. The field test data of a few mangos are not enough. | Please refer to the **Response 1.1** above |
| 1. The absence of time stamps for each spraying and scan makes it difficult to understand the gap between each spray. | The new version of Fig. 8 provides date stamps clearly, as Dat\_0 (bagging), Day\_28 (Spray\_1), Day\_40 (Spray\_2), and Day\_70(plucking) |
| 1. For the sake of a larger data set, It would be better to increase the number of trees and periodic scanning. | Fully agree.  Considering the additional cost of production, the grower prescribed only four scans for the field test. However, in actual implementation, more fruit scans could be implemented say on Day\_50, Day\_60, and so on to get a closer look at the process.  This is a good recommendation, and it is added at the end of IV FIELD TEST |

**Other Revisions**

1. The term “Field Device” was changed to “hand device”
2. The “Wi-Fi network” was changed to “Wi-Fi mesh network”
3. Small worker group deployment was explained with emphasis
4. The scalability concern was cleared with a proper description of small-worker group deployment, which makes the solution deployable independent of the scale of the orchard.