Review of: "Integration and Implementation of Multiple Soil Sensors for Automated and Regulated Irrigation"

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Potential competing interests: No potential competing interests to declare.

Brief Description of the Manuscript

This manuscript presents the development and evaluation of an integrated soil monitoring system for automated and regulated irrigation. The system utilizes multiple soil sensors to measure various parameters, including moisture, temperature, pH, nitrogen, phosphorus, potassium, and electrical conductivity. The collected data is transmitted wirelessly to a user's mobile phone and a computer for analysis and decision-making. The system also includes a control algorithm for automated irrigation based on real-time soil moisture data. The authors conducted laboratory experiments to calibrate the sensors and evaluate the system's performance.

Overall Assessment and Recommendation

The manuscript presents a promising approach to integrated soil monitoring and automated irrigation. The developed system has the potential to improve agricultural practices by providing real-time data on soil conditions and enabling precise irrigation management. However, there are several areas where the manuscript could be strengthened. I recommend that the manuscript be accepted for publication pending revisions that address the concerns outlined below.

Strengths of the Paper

1. **Novelty and Significance:** The development of an integrated soil monitoring system that combines multiple soil parameters and wireless data transmission is a novel contribution to the field of precision agriculture. The system has the potential to improve irrigation management, optimize resource use, and enhance crop yields.
2. **Technical Soundness:** The authors have demonstrated a good understanding of the technical aspects involved in developing the system. The sensor selection, hardware integration, and software development are well-described. The use of laboratory experiments for sensor calibration and system evaluation is appropriate.
3. **Practical Applicability:** The system's affordability, wireless communication capabilities, and user-friendly interface make it potentially accessible and valuable to a wide range of agricultural stakeholders. The real-time data and automated irrigation control can lead to more efficient and sustainable farming practices.

Weaknesses of the Paper and Specific Corrections

1. **Figure Clarity:** Some figures, particularly the circuit diagrams, are not clear and could benefit from improved resolution and labeling. There is also an empty space on the page before the flowchart of the system's software. The flowchart image itself should be improved in its clarity. The authors should ensure that all figures are of high quality and easily interpretable.
2. **Cost-Effectiveness Analysis:** The abstract and introduction emphasize the development of a low-cost system. However, the manuscript lacks a detailed analysis of the system's cost-effectiveness. The authors should provide a breakdown of the costs associated with the components, assembly, and deployment of the system. Additionally, they should compare the cost of their system with existing commercial solutions to demonstrate its affordability.
3. **Wireless Data Transfer Validation:** The manuscript claims that the system has wireless data transmission capabilities. However, there is no evidence or discussion of the validation of this feature. The authors should provide details on how the wireless data transfer was tested and validated, including the range, reliability, and any potential limitations.
4. **Field Testing:** The manuscript focuses on laboratory experiments for sensor calibration and system evaluation. While this is a necessary step, it is important to assess the system's performance under real-world field conditions. The authors should conduct field tests to validate the system's accuracy, reliability, and robustness in a practical agricultural setting.
5. **Sensor Calibration and Integration:** The results section primarily presents sensor calibration data, which is valuable but does not fully address the effectiveness of the integrated system. The authors should provide more comprehensive data on the system's performance when all sensors are integrated and operating together. This would demonstrate the system's ability to monitor multiple soil parameters simultaneously and provide a holistic view of soil conditions.
6. **Limited Data Points:** The number of data points used for sensor calibration and system evaluation is limited (only four in most cases). This raises concerns about the statistical significance of the results and the ability to draw definitive conclusions about the accuracy and linearity of the sensors. The authors should consider increasing the number of data points or acknowledge the limitations of their dataset.
7. **Scope of the Paper:** Given the limitations in the data and analysis, the authors may need to reconsider the scope of the paper. They could either focus on the sensor calibration aspect and present it as a preliminary study or expand the research to include more comprehensive data on the integrated system's performance in both laboratory and field settings.

By addressing these concerns, the authors can significantly strengthen the manuscript and make it a valuable contribution to the field of precision agriculture.