Title: Precision Agriculture Design Method Using a Distributed Computing Architecture on Internet of Things Context

1.1 Motivation: This paper is motivated by the imperative to meet increasing global food demands through the application of advanced technologies. It seeks to address challenges in traditional agriculture by proposing a precision farming system that utilizes a distributed computing architecture within the context of the Internet of Things (IoT). The goal is to optimize resource utilization, enhance real-time monitoring, and leverage data-driven insights for more efficient and sustainable agricultural practices.

1.2 Contribution: This paper contributes a novel precision agriculture design method that integrates a distributed computing architecture within the Internet of Things (IoT) framework. The proposed system optimizes resource utilization, enables real-time data processing, and enhances decision-making in farming practices. By leveraging advanced technologies, the paper offers a practical solution to address challenges in traditional agriculture and promotes sustainable and efficient farming methods.

1.3 Methodology: The methodology of the paper involves addressing the disconnected nature of current agricultural facilities by proposing a user-centered and computing method model. The MQTT protocol is suggested as the communication framework for sensors, actuators, communication nodes, devices, and subsystems.The model aims to integrate various subsystems (irrigation, light, climate, soil, crop, and energy) using a distributed computing architecture based on edge and fog nodes. The process involves user-centered analysis and design, where agricultural experts and ICT technicians collaborate to define main processes. The design phase establishes a three-level architecture (edge, fog, and cloud services) to facilitate interoperability. Integration and data analysis involve the development of installation subsystems and the proposal of machine learning services based on expert rules. The final phase includes startup, measurement, and feedback, incorporating testing, feedback loops, and the development of automatic and adapted rules using artificial intelligence systems. The methodology emphasizes a participatory approach, combining user expertise with advanced computing technologies for improved precision agriculture.

1.4 Conclusion: The paper concludes by highlighting challenges in implementing Precision Agriculture (PA) and IoT in farming, stressing farmer involvement in design. The proposed methodology employs low-cost sensing and innovative communication with edge and fog nodes. Greenhouse experiments validate the model, allowing farmers to design integrated control rules for climate and irrigation. The study foresees future enhancements with machine learning and AI for optimizing agricultural processes.

2.1 First Limitation: Limited Generalizability: The experimental work conducted in a greenhouse may have specific conditions that differ from other agricultural settings. The applicability of the proposed methodology in diverse farming environments might not be fully addressed.

2.2 Second Limitation: Dependency on Farmer Expertise: The paper emphasizes farmer involvement in designing integrated control rules. However, it might not sufficiently address cases where farmers lack the necessary technical expertise, potentially limiting the broader adoption of the proposed methodology in scenarios with less technically adept farmers.

3. Synthesis: The paper examines challenges in implementing Precision Agriculture (PA) and IoT technologies in farming, citing issues like cultural perception, technical expertise gaps, and high start-up costs. It proposes a novel methodology emphasizing farmer involvement, using low-cost sensing and innovative communication with edge and fog nodes. The architecture enables interoperability in climate control and irrigation subsystems, empowering farmers to design integrated control rules. Experimental work in a greenhouse validates the model but raises concerns about generalizability to diverse agricultural settings. The study anticipates future enhancements with machine learning and AI for optimizing agricultural processes. However, it may not fully address limitations related to generalizability and dependency on farmer expertise.