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Introduction

Over the past twenty years, specialized sensors for arti cial vision, global positioning systems, real-time kinematics, laser-based devices and inertial devices, hydraulic cylinder actuators, motors linear and rotary power, and electronics on computers, industrial PCs, and automatons have enabled the integration of many autonomous vehicles, especially agricultural robots [1]. ese autonomous/semi-automatic systems provide precise positioning and guidance in the eld of work, making them capable of performing precision agricultural tasks if equipped with farm tools or implements suitable profession. ese tools with di erent rates of application of fertilizers or sprays, weeders and row seeders are also automated with the same sensors and actuators used in GPS autonomous vehicles. Arti cial sense, range nder, etc. erefore, when integrating a certain vehicle and a particular instrument, many sensors and/or actuators are duplicated and, worse yet, an external central computer must be used to coordinate the arrangement. sort:means and tools. e hardware minimization of the vehicle deployment system is essential to bring the agricultural machinery to market reliably, e ciently, and competitively. erefore, designing a single controller for vehicles and tools will facilitate reliability, e ciency and competitiveness. Many research groups are developing specialized self-driving applications for agriculture that will work for years to come, but many others also aim to operate a group of vehicles under uni ed control. is is the emerging concept of robotic eet, which represents a breakthrough in agriculture [2-5]. e theoretical basis regarding robotic eets has been studied recently, but the rst applications for agriculture are currently under development. To achieve this, the concept of minimizing redundant devices that coordinate di erent heterogeneous systems using an external central computer is very important.

To achieve a eet of exible, reliable, and maintainable autonomous mobile robots for agricultural tasks, the system architecture includes sensors, actuators, and computers that run algorithms for Vehicle navigation and deployment systems should be robust, simple, and modular. One of the most important tasks in designing a control setup is choosing the number and type of sensors, actuators, and computers. ese components form the basis of architectural design and are di cult to reduce in number because cognitive and action processes cannot be avoided; however, these sensors and actuators are o en managed by independent controllers, especially commercially available sensors such as LIDAR and vision systems. However, computers are exible enough to share resources and improve system durability. In fully automated farming systems, multiple actions must be performed simultaneously to ensure e cient as well as safe enforcement, including the system, the crop eld, and external factors, e.g. : human supervisor. Absolute or relative position on the ground, detection of obstacles and objects of interest, communication with external users or with other autonomous units, autonomous navigation or remote operation, and other applications. site-speci c are some of these actions that together form a fully automated system. contain the system. agricultural system [6-10]. is system can be divided into two main subsystems:

[11]. This architecture must be able to integrate different sensor and actuator systems developed by different research groups as well as different types of commercial devices. In addition, it must be flexible and incorporate several standard communication protocols common in high-tech agricultural applications. A modular architecture to provide convenient implementations for the interface between sensors and devices as well as a good organization of the perception, processing and operation of these types of systems is required due to Wide range of technologies available. So, first, this paper focuses on designing a suitable structure for autonomous mobile vehicles to work together as a team of robots on agricultural missions. Hardware reliability, true plug-and-play functionality, and programmability are essential for efficient farm vehicles and therefore a capable, yet modular, robotic fleet of robots. Scalability, ergonomics, maintainability and cost are also important to increase the number of real promising applications in agriculture.

The above basic characteristics are taken into account in the proposed configuration; however, other features are also discussed in the following sections whose main purpose is to provide agricultural machinery manufacturers with solutions for automating new developments, especially in mainstream agriculture. Precision, an emerging field that requires powerful and effective solutions [12,13].

vehicle trajectory and speed, as measured by the number of messages sent to control both the vehicle's speed and direction. Ignoring the vehicle's mechanical response and algorithmic orbital performance, using the original RHEA scheme, the main controller can send noti cations of new orbits at frequencies between 6 and 10 Hz. Using the proposed architecture, the main controller can send noti cations of new speed and direction reference values at 100 Hz. It is incorrect to compare these two values directly because the messages correspond to di erent levels of control. erefore, a qualitative analysis must be performed. e original RHEA diagram de ned the guidance system as a deliberate architecture in which trajectory planning was performed by the master controller based on a prede ned mission and information from the system. awareness and GMUC implementation of this plan. e proposed architecture turns this con guration into a hybrid, where in critical scenarios, such as obstacle avoidance, row guidance, process safety, changeability Vehicle position and orientation are improved.

Conclusions

Robots and new technology have begun to improve conventional agricultural practices, such as increasing yields and reducing the use of chemicals that can have an impact on the environment. In addition, new robotic systems for application in agriculture are being developed to allow the integration of di erent technologies while allowing for modularity, exibility and adaptability. is paper presents a structure so that agricultural vehicles can operate both automatically and in groups, i.e. simple, powerful and reliable. e generic scheme has favorable features for rapid deployment of new vehicle controllers and development/integration of advanced agricultural tools. ree examples are reported here: explosive sprayers, thermomechanical machines and air sprayers. e proposed architecture for centralizing the main controller and main sensor systems o ers certain advantages for future sensor combinations. e integration of important sensors in autonomous agricultural applications, such as high-de nition cameras and laser systems, allows information to be combined to improve the performance of the sensor system in terms of accuracy. Higher durability, and additional data and reduced hardware, increasing the speed of communication and information shared by di erent modules.

References

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