



Artificial Intelligence for the Design of Agricultural Machines and Preliminary Design of Maizor QK2913, a Humanoid Robot that Transforms into a Corn Harvester

Jaime Cuauhtemoc Negrete*

Technical Writer Graduated in Antonio Narro Agrarian Autonomous University, Mexico

***Corresponding Author:** Jaime Cuauhtemoc Negrete, Technical Writer Graduated in Antonio Narro Agrarian Autonomous University, Mexico.

Received: January 06, 2025

Published: January 29, 2025

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Jaime Cuauhtemoc Negrete.

Abstract

In the last decade, agriculture has undergone a significant technology-driven transformation. Artificial intelligence (AI) has established itself as an essential tool in this process, offering innovative solutions that optimize the design and operation of agricultural machines. As the agricultural sector faces challenges such as climate change, resource scarcity, and the need to increase productivity, the integration of AI into machinery design is presented as a viable and effective response. From automated irrigation systems to smart harvesters that use algorithms to maximize harvesting, the applications of AI are vast and varied. These innovations not only seek to increase productivity, but also to reduce the environmental impact of agricultural activities. This article explores how artificial intelligence is revolutionizing the design of agricultural machinery, analyzing current trends, the benefits it offers, and the challenges facing its implementation. It also proposes to examine the crucial role that artificial intelligence plays in the design of modern agricultural machinery and finally a preliminary design of a humanoid robot that transforms into a corn harvester is presented.

Keywords: Artificial intelligence; Agricultural Machines Design; Agricultural Robots

Introduction

In the last decade, agriculture has undergone a significant technology-driven transformation. Artificial intelligence (AI) has established itself as an essential tool in this process, offering innovative solutions that optimize the design and operation of agricultural machines. As the agricultural sector faces challenges such as climate change, resource scarcity, and the need to increase productivity, the integration of AI into machinery design is presented as a viable and effective response. Artificial intelligence (AI) has revolutionized various sectors, and agriculture is no exception. With the rise of digital agriculture, AI has become a key tool for the design and optimization of agricultural machinery. This article explores how AI is transforming the design of agricultural machines, addressing both the benefits and challenges presented by this technological integration. Modern agricultural machines require a more sophisticated approach than merely fulfilling mechanical functions. AI enables the development of systems that not only

perform specific tasks, but also learn and adapt to changing environmental conditions. This includes everything from real-time data collection to automated decision-making, resulting in increased efficiency and sustainability. Agriculture, a fundamental pillar of the global economy, is undergoing an unprecedented technological revolution. In this context, artificial intelligence (AI) has become a strategic ally for the design and optimization of agricultural machinery. As farmers face challenges such as increasing food demand, climate change, and the need for more sustainable practices, the incorporation of advanced technologies becomes indispensable. AI not only improves the operational efficiency of agricultural machines, but also allows for unprecedented customization in their design. From automated irrigation systems to smart harvesters that use algorithms to maximize harvesting, the applications of AI are vast and varied. These innovations not only seek to increase productivity, but also to reduce the environmental impact of agricultural activities. This article explores how artificial intelligence is revolutionizing the design of agricultural machinery, analyzing current trends,

the benefits it offers, and the challenges facing its implementation. It also proposes to examine the crucial role that artificial intelligence plays in the design of modern agricultural machinery and finally a preliminary design of a humanoid robot that transforms into a corn harvester is presented.

Literature Review

Artificial intelligence for the design of agricultural machines

In Mexico, the design of agricultural machines is abandoned due to multiple problems, but this situation can be reversed [24]. The Artificial (AI) intelligence can help in this process. AI allows the analysis of large volumes of data to improve decision making in real time, thus optimizing agricultural production [20]. Computer simulation is another relevant area. This technique allows the creation of virtual prototypes that help engineers evaluate the performance and efficiency of machinery before its physical construction [1,10]. This not only reduces costs, but also speeds up the design process, allowing early adjustments that improve the functionality of the final equipment [2,10]. As agricultural machines become smarter, they face new challenges. The need to process complex data and convert it into useful information is one of the main obstacles that designers must overcome [3]. The continuous learning capability offered by AI-based systems also raises questions about the adaptability and autonomy of these machines in the field Anonymous [2,3].

Recent research highlights the growing importance of artificial intelligence (AI) in agriculture, particularly in the design and optimization of agricultural machinery. Applications of AI in this sector include autonomous machines, sensors for various agricultural activities, and data-driven decision-making tools, the adoption of AI in agriculture faces challenges such as the need for specific legislation and data protection regulations [11]. In Argentina, a study of the agricultural machinery sector revealed opportunities for the implementation of AI in existing machines, new devices, and business process optimization [4]. The flexibility, high performance, accuracy, and cost-effectiveness of AI make it valuable in addressing agricultural challenges such as soil management, disease control, and pest infestations. The technology has shown promise in improving water use, pesticide application, labor efficiency, and soil fertility management. These advancements are crucial to meeting the growing demand for food and creating employment opportunities in the agricultural sector.

In the last decade, agriculture has undergone a significant technology-driven transformation. Artificial intelligence (AI) has established itself as an essential tool in this process, offering innovative solutions that optimize the design and operation of agricultural machines. As the agricultural sector faces challenges, the results of using AI in the design of agricultural machinery are promising. Some key areas where AI has proven its effectiveness:

- **Weed Identification and Removal:** Algorithms that analyze images allow machines to accurately identify and treat weeds [6,8,12,16,30,34,35].
- **Visual Guidance:** Systems that use cameras to keep machines aligned with crops, avoiding damage [5,9,15,26].
- **Smart Harvesters:** Equipment that automatically adjusts its operation based on visual data of the harvested grain [14,17,23,25,27,31,32,37].
- **Disease Detection:** Robots equipped with sensors analyze crops to identify diseases and nutritional deficiencies [1,7,33].
- Sowing and fertilization [13,19,29].
- Multipurpose (sowing, disease detection, chemical application, harvesting, etc.) [18,28,30].

Preliminary AI design of a Transformer that transforms into a corn harvester:

Maizor

A humanoid robot that transforms into a corn harvester is a fascinating example of advanced, multi-functional technology. Here is a possible description of how this robot could work.

Description

Maizor is a humanoid robot designed to perform agricultural tasks, specifically for corn harvesting. Its unique design allows it to transform from a humanoid robot into a corn harvester, making it ideal for work in corn fields.

Transformer mode

In its humanoid mode, Maizor is approximately 1.8 meters tall and weighs around 100 kg. It is equipped with articulated arms and hands that allow it to perform tasks such as crop inspection, sample collection, and equipment repair. It has a head with sensors and cameras that allow it to sense and analyze the environment, including detecting problems with crops.



Figure 1: Maizor in Mode Transformer generated in <https://www.imagine.art/dashboard/image/tool/text-to-image>.

In its Transformer mode, Maizor has the form of a large, powerful robot, with a yellow main body. It has two strong arms and two legs that allow it to move easily. Its head is shaped like a helmet with a visor that allows it to see in all directions.

Harvester mode



Figure 2: Maizor Harvester Mode generated in <https://www.imagine.art/dashboard/image/tool/text-to-image>.

When Maizor transforms into a corn harvester, his body extends and becomes a large wheeled platform. His arms become hydraulic arms that control the cutting blades and corn harvesting systems. His head becomes a control cab with a large window that allows him to see the corn field.

Features and accessories

- **Cutting Blades:** Maizor has two large cutting blades that can cut the corn with ease and efficiency.
- **Harvesting System:** Maizor has a harvesting system that can pick up the cut corn and deposit it into a large bin.
- **Wheels:** Maizor has four large wheels that allow him to move easily around the corn field.
- **Lifting System:** Maizor has a lifting system that allows him to lift the corn bin and empty it into a truck or silo.
- **Control Cab:** Maizor's control cab has a large window that allows him to see the corn field and a control panel that allows him to operate the harvester.

Transformation

Maizor's transformation from a Transformer to a corn harvester is a complex process that involves extending and reconfiguring his body. Maizor's arms and legs become hydraulic arms and wheels, respectively. Maizor's head becomes a control cabin, and the main body becomes a large platform.

Advantages

- **Efficiency:** Maizor can harvest corn efficiently and quickly, reducing the time and effort needed for harvesting.
- **Flexibility:** Maizor can operate in different types of terrain and weather conditions, making him ideal for corn harvesting in different parts of the world.
- **Versatility:** Maizor can transform into a Transformer, allowing him to perform other tasks and operations in the corn field.

When Harvester Mode is activated, he transforms into a corn harvesting machine.

His arms become harvesting arms that can efficiently cut and harvest corn. Its torso becomes a container to store the harvested corn. Its legs become wheels or chains that allow it to move around the corn field in a stable and efficient manner.

Additional features

Maizor is equipped with an autonomous navigation system that allows it to move around the corn field without the need for human intervention. It has a corn quality monitoring system that allows it to detect problems in the harvest and adjust its function accordingly. It can communicate with other robots and crop management systems to coordinate tasks and optimize production. Maizor is a Transformer that transforms into a corn harvester, making it ideal for harvesting corn efficiently and quickly. Its innovative design and ability to transform into a Transformer make it a unique and versatile robot.

Conclusions

Artificial intelligence is redefining the design and operation of agricultural machinery, offering innovative solutions that improve the efficiency and sustainability of the sector. Despite the challenges associated with its implementation, the potential benefits outweigh the initial difficulties. The continued technological evolution promises to further transform agriculture, making a proactive approach necessary to address existing barriers. This preliminary design must be followed to bring it to fruition, it is quite promising and will help the farmers of the future in our country.

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