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DRIVERLESS TRACTOR

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Abstract – Driverless Tractor into agriculture.The field of autonomous automation is of interest to researchers, and much has been accomplished in this area, of which this paper presents a detailed chronology. This paper can help one understand the trends in autonomous vehicle technology for the past, present, and future. We see a drastic change in autonomous vehicle technology since 1920s, when the first radio controlled vehicles were designed. In the subsequent decades, we see fairly autonomous electric cars powered by embedded circuits in the roads. By 1960s, autonomous cars having similar electronic guide systems came into picture. 1980s saw vision guided autonomous vehicles, which was a major milestone in technology and till date we use similar or modified forms of vision and radio guided technologies. Various semi-autonomous features introduced in modern cars such as lane keeping, automatic braking and adaptive cruise control are based on such systems. Extensive network guided systems in conjunction with vision guided features is the future of autonomous vehicles. It is predicted that most companies will launch fully autonomous vehicles by the advent of next decade. The future of autonomous vehicles is an ambitious era of safe and comfortable transportation.

KEY WORDS: autonomous vehicles,adaptive cruise control,embedded circuits.

1.INTRODUCTION

Driverless tractors, a form of autonomous agricultural machinery, are revolutionizing modern farming by leveraging advanced technologies such as GPS, machine learning, computer vision, and IoT (Internet of Things). The adoption of these technologies aims to enhance agricultural productivity, reduce labour costs, and optimize resource utilization.The concept of automation in agriculture dates back several decades,with early efforts focusing on mechanization to reduce manual labor.

However, the integration of autonomous systems into tractors began to gain momentum in the early 21st century. Initial developments were centered around GPS-based navigation systems that enabled precise field operations.

2. Body of Paper

GPS and Navigation Systems: The advent of GPS technology has been a critical enabler for driverless tractors. Studies such as Blackmore et al. (2002) demonstrate how GPS systems can be used for precision farming, providing accurate positioning that is essential for autonomous operations.

Machine Learning and AI: Recent advancements in machine learning and AI have significantly improved the capabilities of driverless tractors. Research by Grisso et al. (2014) highlights the use of AI algorithms to enhance decision making processes in real-time, allowing tractors to adapt to changing field conditions.

Computer Vision: Computer vision technologies are used to identify obstacles
and manage crop health. A study by Bechar and Vigneault (2016) outlines the
application of image processing techniques to detect weeds, pests, and diseases,
enabling targeted interventions.

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14 IoT and Connectivity: The integration of IoT devices facilitates real-time
monitoring and data collection. Wolfert et al. (2017) discuss the role of IoT in
creating interconnected systems that improve the efficiency and effectiveness of
farming operations through data-driven insights.

A radar sensor is a conversion device that can convert microwave echo signals into electrical signals. As we all know, traditional radar technology is widely used, such as airborne, shipborne, base radar, etc... In daily life, we can use radar sensors to achieve weather forecasts, traffic control, and resource surveys, etc... In recent years, with the rapid development of semiconductor technology, the size and power consumption of many radars have been greatly reduced. With the use of millimeter-wave, ultra-wideband technology, and multiple transmission, and multiple receptions, combined with innovative signal processing technology and chips with increasing computing capabilities, the perception function of radar is getting stronger and stronger.

3.METHODOLOGY

LiDAR is an acronym for Light Detection and Ranging. In LiDAR, laser light is sent from a source (transmitter) and reflected from objects in the scene. The reflected light is detected by the system receiver and the time of flight (TOF) is used to develop a distance map of the objects in the scene. LiDAR is an optical technology often cited as a key method for distance sensing for autonomous vehicles. Many manufacturers are working to develop cost-effective, compact LiDAR systems. Virtually all producers pursuing autonomous driving consider LiDAR a key enabling technology, and some LiDAR systems are already available for Advanced Driver Assistance Systems (ADAS).
Comprehensive understanding of their environment, facilitating precise obstacle detection, terrain mapping, and environmental monitoring technology alongside increasing acknowledgment of their benefits in farm operations. Their development is intricately linked to advancements in This holistic approach not only revolutionizes the efficiency and productivity of agricultural operations but also heralds a paradigm shift towards sustainable and environmentally conscious farming practices. As ongoing research and development endeavors continue to push the boundaries of innovation, driverless tractors are poised to emerge as indispensable assets in the modern agricultural landscape, catalyzing transformative advancements and shaping the future of food production.
The Global Positioning System (GPS) is a satellite-based radio navigation system that provides geolocation and time information anywhere on or near Earth where there's an unobstructed line of sight to four or more GPS satellites. Here's a breakdown of its key aspects: Components: Space Segment: A constellation of 24 to 32 operational satellites orbiting Earth and constantly transmitting signals. Control Segment: Ground stations that monitor the satellites' health, update their orbits, and ensure accurate timekeeping. User Segment: GPS receivers in various devices like smartphones, navigation systems, and wearables.

GPS receivers: Continuously receive signals from multiple GPS satellites. Signal Processing: Each received signal includes a timestamp indicating when it was sent from the satellite. Distance Calculation: The receiver calculates the distance to each satellite based on the time difference between signal transmission and reception. Triangulation: Using the distances to at least four satellites, the receiver calculates its own position (latitude, longitude, and altitude) through a process called trilateration.

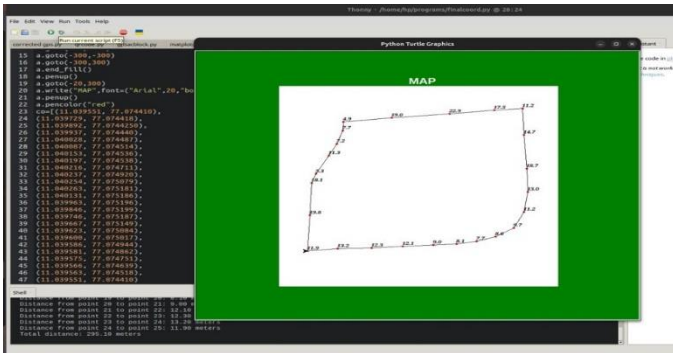

Fig1-Mapping.

4. CONCLUSIONS

Driverless tractors represent a significant leap forward in agricultural automation, offering numerous benefits in terms of efficiency, cost reduction, and precision. However, realizing their full potential requires overcoming technological, economic, and regulatory challenges. Continued innovation and supportive policies will be key to the widespread adoption and success of autonomous tractors in modern agriculture.

The future of driverless tractors looks promising with continuous advancements in technology. Emerging trends such as the integration of blockchain for secure data transactions and the use of renewable energy sources are expected to further enhance the capabilities and sustainability of autonomous farming solutions. Ongoing research and collaboration between industry, academia, and policymakers are essential to address the current challenges and unlock the full potential of driverless tractors.

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