DESIGN & FABRICATION OF IOT BASED AGRIBOT

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Abstract

The agricultural industry has always been a labor-intensive industry, requiring extensive human involvement in activities such as sowing, plowing, watering, and crop cutting. However, recent advancements in technology have made it possible to develop automated solutions that can perform these tasks with minimal human intervention. The proposed IoT-based agricultural robot is a promising solution for efficient and cost-effective farming.

The robot is designed to perform multiple tasks, including sowing, plowing, watering, and crop cutting, with minimal human intervention. The use of sensors to measure temperature, humidity, and soil moisture provides real-time data that can be monitored remotely using an Android app. This allows farmers to make informed decisions and improve the agricultural environment's efficiency.

The robot's working principle involves a multipurpose irrigation vehicle equipped with DC motors and mechanical components to perform various tasks. The water pump is controlled based on the sensor values of moisture level, temperature, and humidity, ensuring efficient water management. The use of a microcontroller to process and monitor the data enhances the robot's performance and accuracy.

The benefits of using agricultural robots extend beyond the individual farmer and can impact the industry. With the growing global population and the increasing demand for food, there is a need for sustainable and efficient farming practices. The use of agricultural robots can help achieve these goals by reducing labor costs, improving crop yields, and promoting sustainability.

The proposed IoT-based agricultural robot is a promising solution for efficient and cost-effective farming. By performing multiple tasks with minimal human intervention, the robot can save farmers time, labor, and money while improving crop quality and reducing production costs. With further development and testing, this technology could have a significant impact on the agricultural industry, making farming more sustainable and profitable.

Keywords: Agribot, IoT, Agriculture automation, Farm automation, low-cost robots

Introduction

The agricultural industry is a crucial sector that plays a significant role in feeding the world's growing population. However, the industry has traditionally been labor-intensive, requiring extensive human involvement in activities such as sowing, plowing, watering, and crop cutting. To address this challenge, an IoT-based agricultural robot has been proposed as a promising solution for efficient and cost-effective farming. This innovative solution is designed to perform multiple tasks with minimal human intervention, including sowing, plowing, watering, and crop cutting, while supplying real-time data through sensors that measure temperature, humidity, and soil moisture, which can be monitored remotely using an Android app. The proposed robot's working principle involves a multipurpose irrigation vehicle that uses DC motors and mechanical components to perform various tasks, with a microcontroller to process and check the data, improving the robot's accuracy and efficiency. This low-cost and wireless communication solution has the potential to revolutionize the agricultural industry, making farming more sustainable and profitable by reducing labor costs, improving crop yields, and promoting sustainability.

The proposed agricultural robot's ability to perform multiple tasks with minimal human intervention is a notable change for farmers. It offers a cost-effective solution that can replace multiple machines used for different farming tasks, providing farmers with a low investment option. Additionally, the

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use of sensors that measure temperature, humidity, and soil moisture supplies real-time data that can help farmers make informed decisions and improve their agricultural practices.

By using the proposed IoT-based agricultural robot, farmers can increase their productivity, efficiency, and profits. This technology can reduce the need for manual labor, saving farmers time and money. Furthermore, the robot's wireless communication capability allows for easy monitoring and control, making it an excellent investment for farmers in remote areas.

The proposed robot's ability to perform five different tasks in one module is a significant advantage over existing robotic vehicles that can only perform one task. This makes it a valuable investment for farmers who need to perform multiple tasks throughout the growing season. Moreover, the robot's low-cost design means that it is accessible to small-scale farmers who may not have the resources to invest in expensive equipment.

In conclusion, the proposed IoT-based agricultural robot is a highly promising technology that has the potential to revolutionize the agricultural industry. Its ability to perform multiple tasks with minimal human intervention, supply real-time data through sensors, and be controlled remotely using an Android app makes it an excellent investment for farmers. By reducing labor costs, improving crop yields, and promoting sustainability, the proposed robot can help farmers increase their productivity and profits while ensuring the continued growth of the agricultural industry.

Statement of the Problem

The use of traditional farming practices that rely on manual labor is a significant challenge for the agricultural industry. These practices can be inefficient and costly, leading to reduced crop yields and lower profits for farmers. However, the development of automated solutions, such as agricultural robots, has been limited due to the excessive cost of existing technology. As a result, small-scale farmers with limited resources cannot afford the investment needed to access this technology.

The lack of available low-cost agricultural robots that can perform multiple tasks, such as sowing, plowing, watering, and crop cutting with minimal human intervention. The solution must be accessible to small-scale farmers and incorporate cost-effective components, such as high-precision sensors, wireless communication, and a robust microcontroller to process and monitor data in real-time. By addressing this challenge, the proposed technology can increase productivity, efficiency, and profits for farmers, promoting sustainability and ensuring the continued growth of the agricultural industry.

Objectives

- Develop a low-cost IoT-based agricultural robot that can perform multiple tasks, such as sowing, plowing, watering, and crop cutting with minimal human intervention.
- Incorporate wireless communication, and a robust microcontroller to process and monitor data in real-time, ensuring the robot's accuracy and efficiency.
- Provide small-scale farmers with a cost-effective solution that can increase productivity, efficiency, and profits, promoting sustainability and ensuring the continued growth of the agricultural industry.

Review of Literature

S. Mary Praveena paper discusses the development of an IoT-based autonomous multipurpose Agri bot designed to minimise the labour of farmers and increase the speed and accuracy of work. Agribot is controlled through IoT for seeding and spraying of pesticides, and the proposed system aims to reduce human intervention, ensuring high yield and efficient utilisation of resources. The system incorporates various sensors to monitor soil and air pressure temperature, with a PIC microcontroller

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used to process data and control the Agri bot. The Agri bot includes relay switches, GPS modules, and a camera for remote monitoring. In general, the system aims to address the problem of a decrease in workforce in agriculture and optimise the maintenance of the crop fields.

Dr. K. Sharmilee paper discusses the design and development of an agricultural robot called AGRIBOT, which can perform various tasks such as sowing, furrowing, watering, and harvesting crops with minimal human intervention. The authors emphasize the importance of robotics in agriculture and how it can help increase productivity while reducing labour costs. The AGRIBOT is controlled using a smartphone and is designed to be efficient and adaptable in executing various field operations. The paper discusses the role of sensors, microcontrollers, and the Internet of Things (IoT) in the development of autonomous vehicles. The paper provides a detailed explanation of the various components of the AGRIBOT, such as the electronic and mechanical platform, motors, and sensors. The article concludes with the potential for further research in this area and the importance of autonomous agricultural robots in increasing productivity while reducing labour costs. The paper was published in the International Journal of Research in Engineering and Science (IJRES), Volume 9, Issue 3, in March 2021.

Akash Mahajan article describes the design and development of a remotely operated Multitasker Agri-bot that can perform various agriculture operations such as seed sowing, harrowing, pesticide spraying, and plant health monitoring. It is an electromechanical vehicle that uses sensors and a web camera to collect data from its environment and makes decisions based on it. The bot is controlled remotely using a smartphone and has a run time of 6 hours.

R. Kishore Kumar paper presents the design and implementation of an IoT-based autonomous multi-purpose Agri BOT. The Agri BOT is designed to assist farmers in various agricultural activities such as soil preparation, seed sowing, crop monitoring, and pesticide spraying. The BOT is equipped with various sensors and actuators, which are integrated with an IoT-based communication system to provide real-time data to the farmer. The system also includes an autonomous navigation system based on computer vision and GPS technology. The paper discusses the various components of the Agri BOT, including the hardware, software, and communication system, and provides details on the implementation and testing of the system.

K. Gowthami paper discusses the current trends and implementation of agricultural and autonomous systems and the potential for future applications. The authors examine different applications of autonomous vehicles in agriculture and compare them with typical systems, focusing on crop institution, plant care, and selective harvesting. The Agri-Bot presented in the paper is controlled by an Android application that is interfaced with hardware via Bluetooth. The paper describes the design features of the Agri-Bot, including its ploughing and seed sowing capabilities. The paper also mentions the use of an Arduino Uno in the design of the Agri-Bot.

Ankit Singh paper titled "Agribot: An Agriculture Robot" describes the design and construction of a robot for agricultural purposes. The robot is designed to perform basic functions like harvesting, spraying, weeding, pruning, planting, and grafting. The robot uses image processing to detect and cut grass in the crop field and analyses the height of the plant for cutting. A vision-based row guidance method is used to guide the robot platform driven along crops planted in rows. The robot is controlled by an ARM7 processor, and the output is visualized on an LCD screen. In general, the article explores the potential of robotics technology in agriculture to increase productivity, improve accuracy, and minimise labour.

Shinde Shital Balaso paper presents the development of an agricultural robot that automates agricultural processes without using force. The robot provides manual control and tracks humidity

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using humidity sensors. The main element of the proposed system is the Advanced Virtual computer architecture (AVR) at mega small controller that supervises the whole method. For manual control, the robot uses a Wi-Fi connection application as a control device and helps the robot navigate in the field. Solar arrays are used for power supply to the robot. Automation is an ideal solution to overcome all the shortcomings by creating machines that perform all operations and automating them to increase yield on a large scale. The proposed system is designed to check the soil depending on moisture level in the soil, to ploughing the seeds with teeth like structure at the end to turn the top layer of soil down, to close the seeds and level the ground automatically, and to provide irrigation by spraying water with a pump in the field.

Amol Gothankar article presents the design and development of an automatic agribot capable of performing various farming operations such as ploughing, field levelling, seeding, watering, and pesticide spraying. The robot is controlled by an Arduino Mega microcontroller and can be navigated manually with an RF remote or automatically using a GPS receiver and magnetometer. Seeding and watering operations are done in parallel on three tracks, which reduces farming time, and pesticide spraying is done continuously. The robot overcomes the drawbacks of traditional farming methods, such as seed and water wastage, high labour costs, and lower land use, by increasing the overall efficiency of the agricultural process.

IoT based agribot.

IoT-based agribots are robotic devices designed to assist farmers in various agricultural tasks using IoT technology. These agribots are equipped with various sensors and communication devices that allow them to collect data and interact with other devices and systems on the farm.

Despite the significant advancements in agribot technology, there are still some gaps in the literature that need to be addressed. One of the major gaps is related to the integration of different IoT-based technologies and their impact on agribot performance. Most existing research on IoT-based agribots has focused on individual technologies such as sensor networks, wireless communication, and robotics, but very few studies have investigated how these technologies can be integrated to create more efficient and effective agribots.

Another significant gap in the literature is related to the development of more intelligent agribots that can adapt to changing environmental conditions. While existing agribots can perform certain tasks autonomously, they lack the ability to make decisions based on changing environmental conditions such as weather patterns or soil conditions. Developing agribots that can learn from their environment and adapt their behavior accordingly could greatly improve their performance and productivity.

Finally, there is a need for more research on the social and economic impact of IoT-based agribots. While these devices have the potential to revolutionize agriculture, their implementation could also have significant social and economic implications. For example, widespread adoption of agribots could lead to the displacement of traditional farm laborers, resulting in job loss and economic disruption. Further research is needed to understand and mitigate these potential negative impacts.

IoT-based agribots have the potential to revolutionize agriculture by improving productivity, efficiency, and sustainability. However, there are still significant gaps in the literature related to the integration of different IoT technologies, the development of more intelligent agribots, and the social and economic impact of their implementation. Addressing these gaps through further research will be critical to realizing the full potential of IoT-based agribots in agriculture.

Methodology:

The agribot is designed to be battery-powered and controlled by Node MCU and Wi-Fi. The Blynk app is used to interact with the robot, allowing for hands-free, smartphone-controlled, and fast data input operations. The robot uses image processing to detect and cut grass in the crop field and analyzes the height of the plant for cutting. A vision-based row guidance method is used to guide the

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robot platform driven along crops planted in rows. The robot is controlled by an ARM7 processor, and the output is visualized on an LCD screen.

Design & fabrication of agribot

Design:

The design of the Agribot involves the creation of a highly efficient and adaptable robot that is equipped with sensors for monitoring soil and air pressure temperature. The robot is controlled by an Android application, which allows for easy monitoring and control of the robot's functions. The Agribot has the potential to revolutionize the agricultural sector by reducing labor costs, increasing productivity, and optimizing the maintenance of crop fields.

The design involves fabricating a multipurpose irrigation vehicle that digs the earth, sows the seeds, and cultivates the crop. The vehicle is equipped with wireless sensor networks and IoT technology, which allows for real-time monitoring of the soil and crop conditions. The vehicle is also designed to be highly manoeuvrable, with a compact design that allows it to navigate through narrow rows of crops.

The design of the Agribot also includes the creation of custom-made components that are designed and constructed with precision and durability in mind. These components include a platform with a base frame, a plough-shaped structure, a seed dispensing system, and a rectangular-shaped leveller. The platform is designed to be lightweight and sturdy, with fiber cardboard used to keep the weight to a minimum while still ensuring that the components are securely held in place.

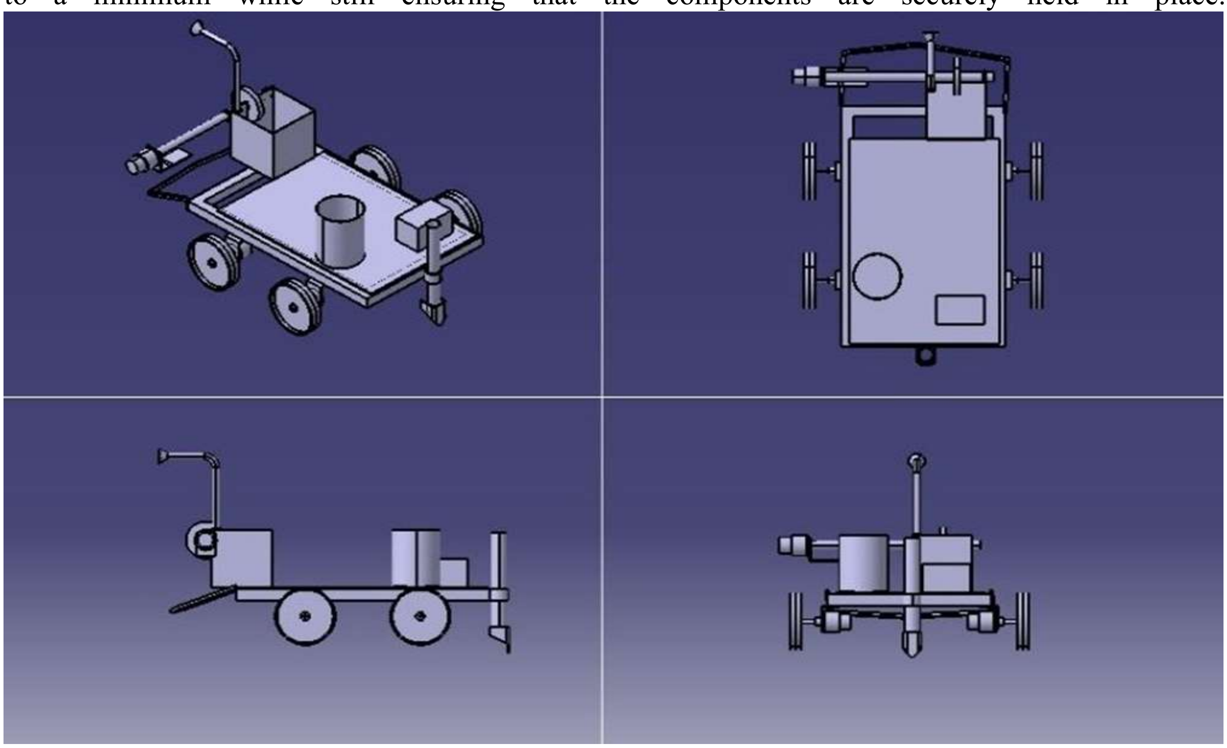

Figure 1 CAD MODEL OF AGRIBOT

Fabrication:

The fabrication of the Agribot involves the creation of a range of custom-made components that are designed and constructed with precision and durability in mind. The fabrication process includes the following steps:

1. Fabrication of the base: The base of the Agribot is fabricated using steel flat bars that are welded together to form a rectangular shape. The use of a steel flat bar provides the necessary strength and rigidity for the structure, while the welded joints ensure that it is securely held together.

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2. Fabrication of the base plate and hinges for the wheel: The base plate and hinges for the wheel are fabricated using steel plates that are cut and welded together to form the desired shape. The hinges are designed to be highly durable and able to withstand the stresses of the vehicle's movement.
3. Fabrication of the plough: The plough-shaped structure is fabricated using a 1.5mm round tube and a metal V-piece that is sourced from a local scrap shop. The round tube provides the necessary rigidity for the structure, while the V-piece contributes to its distinctive shape. The welding process is performed with care to ensure that the structure is strong and secure.
4. Fabrication of the seed box and mechanism: The seed box and mechanism are fabricated using a combination of steel plates and tubes that are cut and welded together to form the desired shape. The mechanism is designed to be highly precise and able to dispense seeds at a consistent rate.
5. Fabrication of the leveller: The leveller is fabricated using steel flat bars that are welded together to form a rectangular shape. By welding the bars together in this way, a sturdy and durable leveller is created that is capable of providing precise measurements.
The fabrication process also involves the assembly of the fabricated parts with electronic components, including wireless sensor networks and IoT technology. The assembly is performed with care to ensure that all components are securely held in place and that the Agribot can function at optimal levels.

Conclusion

- The Agribot is an IoT-based robot designed to perform multiple tasks with minimal human intervention.
- The robot's design and fabrication involve the creation of a sturdy frame, seed box and mechanism, and leveler using steel plates and tubes.
- The assembly process involves the integration of electronic components, including wireless sensor networks and IoT technology.
- The Agribot is a low-cost, efficient option for farmers that has the potential to revolutionize the agricultural sector.

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