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Solar Energy Based Agriculture Robot

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ABSTRACT: The project aims to address the challenges faced by traditional agricultural practices by introducing an innovative and sustainable solution. The robot is powered by solar energy, minimizing its environmental impact and reducing reliance on conventional energy sources. Equipped with advanced sensors and automation capabilities, the robot can perform various agricultural tasks, such as planting, watering, and monitoring crop health, with increased efficiency and precision. This project not only contributes to the promotion of clean energy but also enhances agricultural productivity and resource utilization through smart robotic technologies. The Solar Energy-Based Agriculture Robot represents a significant step towards sustainable and technologically advanced farming practices.

KEYWORDS: Agricultural, Microcontroller, Sensors, Internet of Things (IOT), Solar Energy, etc.

I. INTRODUCTION

The history of agriculture spans thousands of years, and various climatic conditions, cultural traditions, and technological advancements influenced and shaped its growth. The agricultural system therefore should be improved to lessen the farmers' labor. The model created to mechanically plant seeds and spray Using pesticides and cutting the grass. The prototype is an example of modern technology for enhancing agricultural processes, including planting seeds, trimming grass, and applying pesticides based on robotic support.

The document is structured in the manner described below. Section II displays comparable works that have already been published. The suggested layout of Section III introduces a versatile agricultural robot. Section IV talks about how the algorithm is put into practice.

The introduction to the project addresses the need for transformative solutions in agriculture, acknowledging the challenges faced by conventional farming methods. Traditional agricultural practices often encounter inefficiencies and resource limitations, necessitating innovative approaches to meet the growing demands of the global population. In response to these challenges, the project proposes the development of an autonomous agriculture robot powered by solar energy.

The integration of solar energy as the primary power source signifies a commitment to sustainable and eco-friendly practices. By harnessing the abundant and renewable energy from the sun, the robot aims to reduce the carbon footprint associated with conventional agricultural machinery. The introduction highlights the dual objectives of enhancing agricultural efficiency and promoting environmental sustainability through the adoption of solar-powered robotics.

Furthermore, the introduction sets the stage for the project's focus on advanced technologies, such as sensors and automation that enable the robot to perform a range of agricultural tasks autonomously. The overarching goal is to usher in a new era of precision farming, where technology-driven solutions contribute to increased productivity and resource optimization. The Solar Energy-Based Agriculture Robot embodies a forward-looking approach to address the evolving needs of the agricultural sector while aligning with the principles of clean energy and technological innovation.

II. RELATED WORK

As there are no efficient equipment's to aid the farmers. There is a need for new techniques to be implemented. Once the idea was formulated, design options were finalised.

In [1], Saurabh Umkar and Anil Karwankar, discussed that the process of seed sowing is a key component of agriculture field. For many crop varieties, high-precision pneumatic planting has been developed for a wide range of seed sizes, resulting to uniform seed distribution in seed spacing along the travel path. Wifi is used as receiver. Main disadvantage of the system is robot moves in only one direction. Whenever there is obstacle power supply is automatically turned OFF.

In [2], M.D. I. Sujon, R. Nasir and Jayasree Baidya, agricultural researcher determined the effects of various seeding techniques and machines and also different rates of oil seed rape application on establishment of seed emergence plant and final yield of grain. The robot will perform farming using analogy of ultrasonic detection in order to change its position. The main disadvantage of this system is, it does not work well on all types of soil.

In [3], H. Pota R Eaton, J Katupitiya and S D Pathirana, concludes that bullock drawn planting becomes a necessity to sow as skilled sowing workers are almost decreasing. Planting distance and plant population are acute factors in maximizing the yield of crops. In this Microcontroller 8051 is used for communication between the input and output devices. The main drawback of this model is, it consists of only one mechanism.

In [4], S. Kareemulla, K Shaik, E Prajwal, B Mahesh, V Reddy, the system benefits farmers in the basic operation of seed sowing. This machine's operating mode is simple. It is possible to increase the total yield percentage effectively. Labour problem can be reduced. As compared to the manual and tractor based sowing time and energy required for this robot machine is less. Also wastage of seed is less. The disadvantage of model is, it consists of only one mechanism. The above research papers helped to understand the different aspects posed by the research on the agricultural robot. The robots designed in the above literature surveys have many issues with movement of the robot and grass cutting. These problems are effectively addressed in this work. Three mechanisms are implemented in the designed robot unlike the robots designed previously. This work also throws light on the future scope of robots.

III. METHODOLOGY

Proposed Methodology:

The Solar Energy-Based Agriculture Robot project will employ a systematic and multidisciplinary approach to achieve its objectives. The methodology can be outlined as follows:

- System Design:
 - Define the specific functionalities and tasks the robot will perform, such as crop monitoring, weed detection, and irrigation.
 - Design the mechanical structure, incorporating solar panels for energy harvesting and sensors for data collection.
- Energy Harvesting:
 - Implement efficient solar panels on the robot to harness solar energy.
 - Design a power management system to store and distribute energy for continuous operation.
- Sensor Integration:
 - Integrate various sensors for precision agriculture, including soil moisture sensors, cameras for crop monitoring, and obstacle detection sensors.
 - Implement sensor fusion techniques for comprehensive data analysis.
- Autonomous Navigation:
 - Develop algorithms for autonomous navigation using GPS and obstacle avoidance mechanisms.
 - Implement machine learning models for path planning and decision-making based on sensor inputs.
- Communication System:
 - Establish a communication system for real-time data transfer between the robot and a central control unit or cloud platform.
 - Implement protocols for remote monitoring and control.
- Testing and Optimization:
 - Conduct extensive testing in controlled environments to validate the robot's performance.
 - Optimize algorithms and parameters for efficiency and accuracy.

Discussion:

The proposed methodology is designed to create an autonomous and energy-efficient agriculture robot capable of performing tasks crucial to precision farming. The integration of solar energy ensures sustainability and extended operational periods, reducing the need for frequent recharging or manual intervention. The choice of sensors enables the robot to gather valuable data about soil conditions, crop health, and environmental factors.

Autonomous navigation ensures that the robot can move seamlessly through the agricultural field, avoiding obstacles and performing tasks with minimal human intervention. The communication system facilitates real-time monitoring and control, allowing farmers to make informed decisions based on the data collected by the robot.

Throughout the development process, continuous testing and optimization will be conducted to ensure the reliability and effectiveness of the robot in real-world agricultural scenarios. The project aims to contribute to the advancement of sustainable and technology-driven agriculture practices, addressing challenges such as resource optimization and environmental impact.

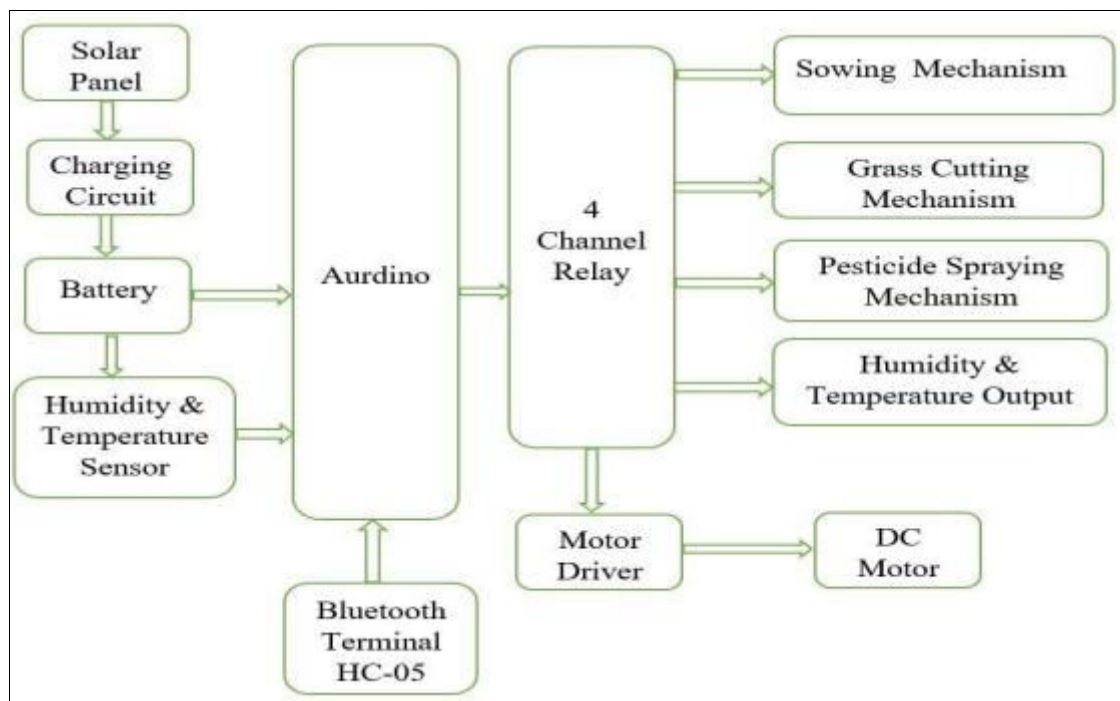


Fig.1: Proposed System Block Diagram

IV. EXPERIMENTAL RESULTS

The planned robot will simultaneously carry out the tasks of seeding, applying pesticides, and cutting the grass. Heat from the solar panel turns sunlight into power. The charging circuit receives this electrical energy. In order to provide pulsed voltage and prevent reverse current, the charging circuit will operate in accordance with the maximum power point tracking (MPPT) protocol. To charge the battery, the pulsed voltage is applied. Voltage sensors are used to manage the battery's charge. Due to its bidirectionality, the battery can charge and supply voltage to the Arduino simultaneously. High pass filtering is used to feed the voltage source with continuous oscillation into Arduino. All separate mechanisms receive voltage feed via the channel relay. The DC motors that power the robot are driven by the motor driver.

V. CONCLUSION

We have implemented an Solar Energy based agriculture robot. To carry out difficult farming activities including seed sowing, grass cutting, and pesticide spraying, an autonomous multipurpose agricultural robot is created. Two different sized seeds are to be sown using this work. Reduced human interaction and effective resource use are two advantages of robots. Bluetooth is used to communicate instructions to the system, ensuring that no direct human touch occurs and guaranteeing the operator's safety. Since the robot is solar-powered, renewable energy is being used. Android apps are used to carry out the tasks. Innovative equipment for grass cutting, spraying pesticides, and spreading seeds has a big impact on agriculture. Farmers can save a lot of money on labour and more time by adopting this advanced job.

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