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Hybrid Solar Seeder For Agriculture With Dual Power

[1] Shivalingaiah k l, [2]Sai Vivek Y, [3]Aishwarya S, [4] Pooja H Patel

[1]Assosiate Professor, [2]Student , [3]student, [4] student

[1] Department of Electrical and Electronics Engineering, Rajarajeswari College of Engineering, Bengaluru, India.

Abstract: This paper proposes a novel approach to modernize agricultural practices by introducing a solar-powered seed sowing robot controlled via a dedicated application. The robot integrates Arduino-based hardware for precise seed placement and efficient resource utilization. Leveraging solar energy ensures sustainability and autonomy in remote agricultural areas. The accompanying mobile application offers user-friendly control, enabling farmers to customize seeding patterns and monitor progress remotely. This innovative system promises increased efficiency, minimize labor requirements reduced labor, and optimized crop yield, contributing to technology-driven agriculture for the future.

Index Terms - Renewable Energy, Autonomy, solar power

I. INTRODUCTION

In an era marked by environmental challenges and the imperative for sustainable practices, agriculture stands at a critical crossroads. The demand for efficient, eco-friendly solutions has never been more pressing. Enter the Solar Seed Sowing Robot, a groundbreaking innovation poised to transform the landscape of farming. This introduction delves into the genesis, functionality, and potential impact of this revolutionary technology.

The idea behind the Solar Seed Sowing Robot emerged from a confluence of factors: the growing demand for increased agricultural productivity, the necessity of reducing manual labor in farming, and the urgency of embracing renewable energy sources. Drawing inspiration from these challenges, a team of visionary engineers started a journey to generate a solution that would combine automation with sustainability.

Powered by Arduino technology, the robot operates seamlessly with the aid of a user-friendly mobile application. Harnessing the abundant energy of the sun, it autonomously navigates fields, sowing seeds with precision and efficiency. Equipped with intelligent algorithms, the robot adapts to varying soil conditions, ensuring optimal planting depth and spacing .Moreover, its versatile design allows for easy customization and scalability, catering to diverse agricultural needs.

Beyond its technological prowess, the Solar Seed Sowing Robot holds the promise of transforming communities and empowering farmers. By streamlining the sowing process and increasing productivity, it has the potential to enhance food security and economic prosperity in rural areas. Moreover, by promoting sustainable farming practices, it fosters resilience in the face of environmental challenges and market fluctuations. As such, it serves as a impulse for positive transformation , fostering a future where agriculture is not only high yielding but also regenerative and equitable.

Despite its immense potential, the journey towards widespread adoption of the Solar Seed Sowing Robot is not without its challenges. From technological barriers to economic considerations, numerous hurdles must be overcome to realize its full impact. However, with perseverance, collaboration, and strategic investment, These obstacles can be turned into chances for expansion and creativity. By utilizing the collective expertise and resources of stakeholders across the agricultural value chain, we can pave the way for a more sustainable and prosperous future.

The implications of the Solar Seed Sowing Robot extend far beyond the confines of individual farms. By automating the sowing process, it liberates farmers from tedious manual labor, allowing them to focus on higher-value tasks such as crop management and innovation. Moreover, by harnessing solar energy, the robot reduces reliance on fossil fuels, mitigating carbon emissions and contributing to a cleaner environment. In essence, it represents a paradigm shift in agricultural practices, aligning productivity with sustainability.

the Solar Seed Sowing Robot epitomizes the fusion of technology and ecology, offering a glimpse into the future of agriculture. As we stand on the brink of a new agricultural revolution, driven by innovation and necessity, this groundbreaking technology serves as a beacon of hope. With its potential to enhance productivity, conserve resources, and mitigate environmental impact, it stands poised to reshape the manner we cultivate the land. The journey towards a more sustainable and resilient food system begins here, with the Solar Seed Sowing Robot leading the way.

II. OVER VIEW

In the realm of modern agriculture, precision and efficiency are paramount. Introducing an innovative solution, an automated seed sowing robot empowered by Arduino technology and seamlessly controlled through a mobile application. This groundbreaking system revolutionizes traditional farming practices by offering precision, convenience, and enhanced yield optimization. The core of this seed sowing robot lies in its integration of hardware and software, marrying the robust capabilities of Arduino with the accessibility and user-friendly interface of a mobile application.

The automated seed sowing robot, powered by Arduino technology and complemented by a user-friendly mobile application, represents a paradigm shift in modern agriculture. By harnessing the power of automation, precision, and data-driven decision-making, this innovative solution empowers farmers to optimize their operations, maximize yields, and promote sustainable farming practices. As the agricultural landscape continues to evolve, such advancements pave the way for a greater efficient, productive, and environmentally conscious future.

III. OBJECTIVE

The primary goal of this project is to design a hybrid agricultural robot which works mainly on renewable energy and to help the farmers to do their basic farming activities on their own. Usually, farmers sow seeds by walking through the fields or through a tractor which consumes petrol or diesel. And when they walk through the field they might get affected by pesticides, Insects etc. This system would help in avoiding the usage of fossil fuels, provide them safety by not being physically present in the farming area and it will help the new farmers to train themselves by understanding few technologies.

- Renewable source of energy
- Safety for farmers
- Precision Sowing.
- Variable seed Dispensing.
- Autonomous Navigation.
- Real time monitoring.
- Mobile Control and Monitoring.
- SDG’s (social development goals).

IV. BLOCK DIAGRAM

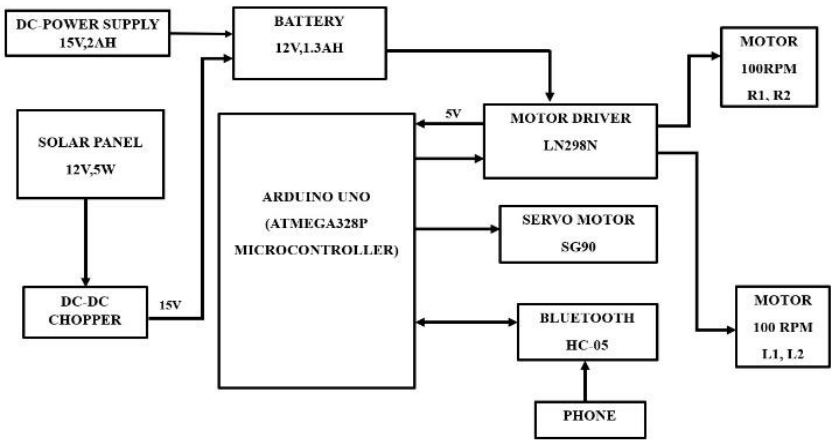

Fig. 1: Block Diagram of Entire System

The solar panel of 5w,12 volts is accustomed to convert solar energy to electrical energy. the output of the solar panel is given to the DC to DC Chopper designed to obtain a regulated output of 5v to 14v. this output is given to the 12v battery which powers the motor drivers to control the speed and direction of the 150 rpm gear motors. the 5v of the motor driver powers the Arduino uno. a servo motor is connected to Arduino uno which acts as a door for the falling of seeds. the entire module is connected to the mobile application developed, by dint of bluetooth module HC-05. Due to certain climatic conditions sometimes, the solar energy may not be constant, during those times we can give the DC power supply of 15V, 2A to the battery directly thus acting as a backup source. Therefore, using this method we can charge battery within 3 hours. Thus, this model is designed to work effectively across various climatic conditions.

V. METHODOLOGY

Solar powered remote controlled seed sower is a device which works on solar energy with the help of Bluetooth. Solar panel is the key component of this device. Solar panel receives and stores all the solar energy and then converts it into Electrical Energy and stores it to battery thus farmer doesn't need to worry about the charging of battery. And in addition to this we set the program in Arduino UNO. So now the whole device going to work on remote/mobile app with the help of Bluetooth.

The solar-powered seed sowing robot lies the solar panel, a vital component responsible for harnessing solar energy. Once solar energy is captured, it needs to be regulated and stored for later use. This is where the DC-to-DC chopper comes into play. The DC to DC Chopper serves as an intermediary between the solar panel and the battery, ensuring that the electrical energy generated by the solar panel is appropriately regulated before being stored in the battery. Regulation is crucial to prevent overcharging or undercharging, which can compromise the longevity and performance of the battery.

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The battery serves as an energy reservoir, storing the electrical energy generated by the solar panel for future use. In this solar-powered seed sowing robot, a 12V battery is utilized to store the harvested solar energy. This battery acts as a reliable power source, providing continuous energy supply to the various components of the machine, irrespective of fluctuations in solar availability.

Efficient power distribution is necessary to ensure that energy is distributed to the different components of the seed sowing robot as required. The battery serves as the primary power source, supplying energy to the motor driver and the Arduino Uno. The motor driver acts as an interface between the Arduino Uno and the DC motors responsible for mobility of the robot and controlling the seed sowing mechanism.

The Arduino Uno microcontroller serves as the brain of the system, executing pre-programmed instructions to coordinate the operation of the robot . By interfacing with sensors and actuators, the Arduino Uno can precisely control the movement and functionality of the seed sowing machine, ensuring accurate and efficient seed placement.

The pivotal feature of the solar seed sower is its remote-controllability via a application. This is made possible through Bluetooth connectivity, which enables wireless communication between the machine and a mobile device. By developing a dedicated mobile application, users can remotely control the mobility of the seed sowing machine, adjust seed sowing parameters, and monitor its operation in real-time.

The Bluetooth module facilitates seamless communication between the machine and the mobile application, allowing for intuitive and user-friendly management of the agricultural device. This remote-control functionality enhances convenience and accessibility, empowering farmers to efficiently manage seed sowing operations from a distance.

In agricultural settings, Environmental conditions fluctuate noticeably over the time , posing challenges to consistent operation. To address this issue, the solar-powered seed sowing robot is equipped with a built-in capability for seasonal adaptation. During periods of low sunlight, such as winter or inclement weather, the machine can be supplemented with a DC power supply to ensure uninterrupted operation.

The solar-powered remote-controlled seed sowing robot represents a remarkable fusion of renewable energy, advanced control technology, and agricultural innovation. By harnessing solar energy and integrating remote-control functionality, this device offers farmers a cost-effective and efficient solution for seed sowing operations. With its ability to adapt to seasonal variations and provide seamless mobile control, the seed sowing robot exemplifies the potential of technology to revolutionize modern agriculture.

VI. CIRCUIT DIAGRAM

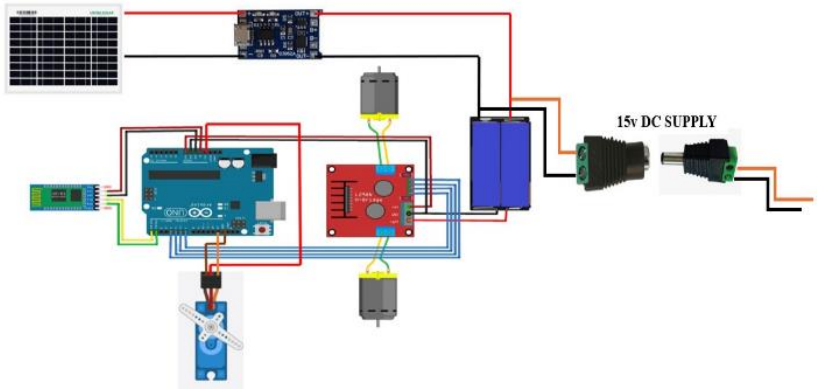

Fig.2: circuit diagram

Solar panels generate DC (direct current) electricity when exposed to sunlight. Connect the positive (+) and negative (-) terminals of the solar panels to the corresponding terminals on the DC to DC Chopper. The DC to DC Chopper regulates the voltage to 15V and charges the battery.

The battery stores the energy generated by the solar panels. Connect the positive and negative terminals of the battery to the corresponding terminals on the DC to DC Chopper.

The positive terminal of the battery is connected to the motor driver 12v and negative terminal of the battery Is grounded and Shorted between motor driver and Arduino. Then the Arduino connections with the motor driver is done accordingly and the terminals of the DC gear motor are connected to the motor driver respectively and the connections of the Bluetooth module and servo motor to the Arduino Uno is done respectively.

After all the connections is correct then the program is been Uploaded to the Arduino. While uploading the program ensure that transmitting and receiving terminals of the Bluetooth module is disconnected from Arduino.

An additional DC supply can be given to the battery by connecting to its positive and negative terminals and the same operation can be performed by the robot.

VII. RESULT AND DISCUSSION

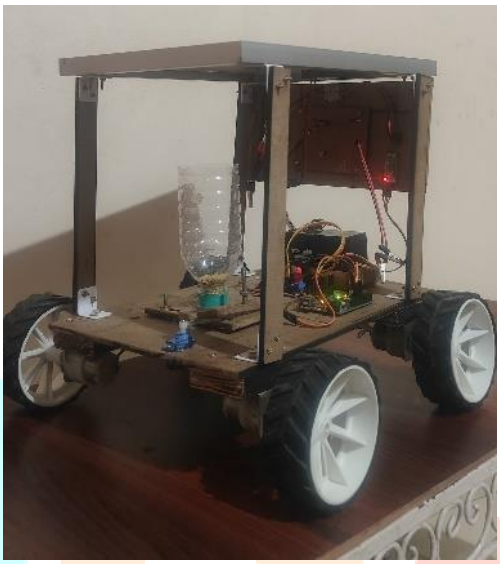

Fig.3: Outcome of Solar seed sowing

The evolution of a seed sowing robot for agriculture utilizing Arduino technology alongside a mobile application represents a significant advancement in precision farming. The robot's operational capabilities, driven by Arduino's flexibility and the mobile app's intuitive interface, streamline the sowing process, optimizing resource utilization and enhancing crop yield. Through meticulous testing and refinement, the robot demonstrates reliable performance in various soil conditions, ensuring uniform seed distribution and proper depth placement. Furthermore, the integration of the mobile application empowers farmers with real-time monitoring and control, enabling remote operation and data-driven decision-making. Overall, this innovative solution holds great promise in revolutionizing agricultural practices, offering efficiency, accuracy, and convenience to farmers while contributing to sustainable food production.

VIII. CONCLUSION

By implementing a seed-sowing robot for agriculture, powered by Arduino and complemented by a mobile application, a promising solution for efficient and precise farming practices can be achieved . This integrated system combines hardware and software to automate the process of seed sowing, enhancing productivity and reducing manual labor. Through remote control and real-time monitoring via the mobile application, farmers can optimize seed distribution, adapt to varying field conditions, and ultimately improve crop yield. Overall, this innovative approach signifies a significant step towards sustainable and technology-driven agriculture.

IX. FUTURE SCOPE

The future scope for a solar seed sowing robot for agriculture using Arduino and a mobile application is quite promising.

1. Precision Agriculture Integration: Enhance the robot's capabilities to include sensors to track the moisture levels of the soil, the acidity(pH levels")and presence of nutrient. This data can be transmitted to the mobile application, providing farmers with real-time insights for better decision-making.

2. Multi-functionality: Expand the robot's functionality to not only sow seeds but also perform tasks like weeding, fertilizing, and pesticide spraying. This would offer a comprehensive solution for crop management.

3. Autonomous Navigation: Develop algorithms for the robot to navigate on its own without human intervention., allowing the robot to operate efficiently in complex agricultural environments without any human interference.

4. Scalability: Design the robot to be scalable, allowing it to operate on both small and large farms. This could involve modular design components that can easily be customized based on the size and layout of the farm.

5. Data Analytics and Machine Learning: Implement data analytics and machine learning algorithms in the mobile application to analyze historical data and provide predictive insights for optimizing planting schedules, crop yields, and resource utilization.

6. Integration with Agricultural Databases: Integrate the mobile application with agricultural databases and weather forecasting services to provide farmers with access to comprehensive information for informed decision-making.

7. Remote Monitoring and Control: Enable farmers to remotely monitor and control the robot through the mobile application, allowing them to manage their farms efficiently from anywhere.

By focusing on these areas of development, a solar seed sowing robot for agriculture using Arduino and a mobile application can significantly contribute to improving efficiency, productivity, and sustainability in modern farming practices.

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