e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

SOLAR SEED SOWING SYSTEM

Shushma Telrandhe*1, Priti Turkar*2, Laxmi Kohare*3, Khushi Kelwade*4

*1Professor, Department Of Electronics & Telecommunication, Gurunanak Institute Of Engineering And Technology, Nagpur, Maharashtra, India.

*2,3,4Students, Department Of Electronics & Telecommunication, Gurunanak Institute Of Engineering And Technology, Nagpur, Maharashtra, India.

ABSTRACT

The "Smart Seed Sowing System" is an advanced agricultural automation system designed to revolutionize traditional farming by automating the seed sowing and irrigation processes. Powered by solar energy, it integrates robotics and microcontroller technology, reducing manual labor while ensuring precise seed placement and efficient water usage.[1] The robot navigates autonomously, equipped with a seed sowing mechanism, a water pump, and spray nozzle, delivering seeds and water with pinpoint accuracy to optimize germination and minimize resource waste. Central to its operation is an ESP32 microcontroller, which coordinates the system's components, including motors, sensors, and a cloud- connected application.[2] This cloud integration enables real-time data monitoring and remote control, allowing farmers to make data-driven decisions that enhance productivity and resource management. The system promotes sustainability through its reliance on solar power, making it cost-effective and environmentally friendly, especially for smallholder farmers in remote or off-grid areas[3]. By automating labor-intensive tasks and utilizing renewable energy, the Smart Seed Sowing Robot addresses key challenges in modern agriculture, such as labor shortages, inefficiencies, and environmental concerns, paving the way for more sustainable, efficient, and precision-driven farming practices.

Keywords: ESP32, LCD Display, Solar Panal, IR Sensor.

I. INTRODUCTION

The "Smart Seed Sowing System" represents a significant innovation in agricultural automation, designed to address key challenges in modern farming by introducing efficiency, sustainability, and precision to the planting process. Traditional farming methods, which rely heavily on manual labour, often result in inconsistent seed placement, inefficient water use, and higher operational costs. These challenges are compounded by the growing global demand for food and the necessity to adopt more sustainable practices in agriculture.[4] The Smart Seed Sowing Robot seeks to overcome these limitations by automating the dual processes of seed sowing and irrigation, enabling farmers to achieve better resource management, higher crop yields, and reduced environmental impact. At the core of the system is a solar-powered, autonomous robot equipped with advanced microcontroller technology, capable of navigating fields with precision. The use of solar energy makes the robot environmentally friendly and economically viable, especially in areas where access to conventional energy sources is limited. The system's ESP32 microcontroller acts as the brain of the operation, coordinating various components, including motors, sensors, and relays, to control the seed sowing mechanism, water pump, and obstacle-detection sensors [5]. This level of automation ensures that seeds are placed at consistent intervals and receive the correct amount of water, optimizing conditions for germination and plant growth

The A key feature of the Smart Seed Sowing Robot is its dual functionality, which combines the traditionally separate tasks of planting and irrigation into a single, integrated process. The seed sowing mechanism is designed to precisely place seeds at predetermined intervals, ensuring uniform distribution across the field. Simultaneously, the automated irrigation system, controlled by a water pump and spray nozzle, delivers the right amount of water to each seed, promoting healthy germination while minimizing water wastage[6]. This efficient use of water is particularly important in regions where water scarcity is a concern, making the system both resource-conscious and highly effective.

In addition to its hardware capabilities, the system incorporates cloud-based data storage and monitoring, enabling farmers to remotely track the robot's progress, adjust settings, and receive updates on its performance through a mobile application. This feature allows for real-time decision-making and better farm management, as farmers can monitor field conditions and make adjustments to the robot's operation based on data insights. [5] The system's ability to store and analyze data from multiple planting cycles offers long-term benefits, allowing for better planning and optimization of resources in future planting seasons. Overall, the Smart Seed Sowing Robot addresses several critical needs in modern agriculture by enhancing productivity, reducing labor and operational costs, and promoting sustainable farming practices. Its solar-powered design, combined with its ability to automate key agricultural tasks, positions it as a forward-looking solution for farmers who seek to increase efficiency and reduce their environmental footprint. By offering precision, reliability, and real-time connectivity, the system holds the to significantly improve.

II. LITERATURE SURVEY

1. Mahesh R. Pundkar [1] stated that the seed sowing machine is a key component of agriculture field. high precision pneumatic planters have been developed for many verities of crops, for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path in seed spacing.
2. M.A. Asoodar [2] another agricultural researcher determined the effects of different seeding technique and machines and also different rates of oilseed rape application on seeding emergence, plant establishment and final grain yield.3. P.P. Shelke [3] concludes that bullock drawn planters are becoming necessity for sowing as the skilled workers for sowing are almost diminishing. Planting distance and plant population are crucial factors in maximizing the yields of crops.
3. P.P. Shelke [3] concludes that bullock drawn planters are becoming necessity for sowing as the skilled workers for sowing are almost diminishing. Planting distance and plant population are crucial factors in maximizing the yields of crops.
4. Singh (1971)[4] revealed that by using a seed drill for wheat crop there was an increase in yield by 13.025 percent when compared with the conventional method, it also revealed that by using a seed drill for wheat crop, a saving of 69.96 per cent in man-hours and 55.17 percent in huliock hours was achieved when compared, with the conventional method.
5. Umed Ali Soomro at al. [4] in Pakistan has evaluated three sowing methods and seed rate in a four replicated RCBD method and concluded that drilling method of sowing at seed rate 125 kg/ha is optimal for yield and quality of wheat grains, because the said sowing method and seed rate distribute seed uniformly and desired depth which provide appropriate depth for seed germination and crop establishment.
6. The main goal of M.A. Asoodar [2] another agricultural researcher determined the effects of different seeding technique and machines and also different rates of oilseed rape application on seeding emergence plant establishment and final grain yield

III. METHODOLOGY

To develop a sustainable seed sowing method utilizing solar energy to enhance agricultural efficiency and reduce reliance on fossil fuels.

1. Materials Needed

1. Solar-powered seed sowing machine or system
2. High-quality seeds (appropriate for the region)
3. Soil testing kit, Water management system (e.g., drip irrigation)
4. Protective coverings (e.g., shade cloth)
5. Monitoring equipment (sensors for soil moisture, temperature, etc.)

2. Site Selection

1. Choose a suitable agricultural site with optimal sunlight exposure.
2. Conduct soil testing to ensure appropriate pH and nutrient levels.

3. Preparation of Soil

1. Clear the field of debris and weeds.
2. Till the soil to a suitable depth to enhance seed bed preparation.
3. Amend the soil based on testing results (add organic matter, fertilizers, etc.).

4. Seed Selection

1. Choose seeds that are well-adapted to the local climate and soil conditions.
2. Consider using native or drought-resistant varieties for sustainability.

5. Design of Solar Seed Sowing System

1. Utilize solar panels to power the seed sowing machine.
2. Ensure the system can operate autonomously or with minimal manual intervention.
3. Incorporate features like adjustable seed depth and spacing for various crops.

6. Sowing Process

1. Use the solar-powered machine to sow seeds at the optimal time (considering weather forecasts and soil moisture levels).
2. Monitor seed placement for depth and spacing accuracy.

7. Water Management

1. Implement a solar-powered irrigation system to provide consistent moisture.
2. Use drip irrigation to minimize water waste and ensure efficient delivery.

8. Monitoring and Maintenance

1. Regularly check the health of seedlings using soil moisture and temperature sensors.
2. Maintain the solar panels and sowing equipment to ensure efficiency.

9. Data Collection and Analysis

1. Collect data on germination rates, growth patterns, and yields.
2. Analyze the effectiveness of solar-powered sowing compared to traditional methods.

10. Evaluation and Feedback

1. Gather feedback from participants (farmers, agronomists) to assess the methodology's effectiveness.
2. Make adjustments based on observations and data collected.

11. Scale-Up and Dissemination

1. If successful, consider scaling the methodology to larger areas or different crops.
2. Share findings and best practices with the agricultural community through workshops or publications.

IV. COMPONENT

ESP32

The ESP32 is a low-cost, low-power microcontroller with built-in Wi-Fi and Bluetooth capabilities, making it ideal for IoT applications. In the 'E-Trolley with Cloud Billing System,' the ESP32 serves as the central processing unit, managing the barcode scanning, LCD display, and motor control, while also connecting the trolley to the cloud via Wi-Fi. It processes the scanned product data, communicates with the cloud platform (using Blynk software), and ensures real-time synchronization of billing information, enabling a seamless, automated shopping and billing experience.

LCD Display

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

An LCD (Liquid Crystal Display) is a flat-panel display technology commonly used in various electronic devices to visually present data and information. In the Smart Seed Sowing Robot system, the LCD display is used to provide real-time feedback on the robot's operational status, such as seed count, water levels, battery status, and system performance. It allows the farmer or operator to quickly view critical information during operation, making it easier to monitor the robot's functions without relying solely on the cloud application. This display enhances user interaction and helps in troubleshooting or making manual adjustments on-site

Solar Panel

A solar panel is a device that converts sunlight into electrical energy using photovoltaic cells. In the Smart Seed Sowing Robot system, the solar panel serves as the primary power source, harnessing solar energy to charge the robot's battery. This sustainable energy solution allows the robot to operate autonomously in the field without relying on external power sources, making it highly efficient and cost- effective, especially in remote or off-grid areas. The use of solar power reduces operational costs and supports the robot's eco-friendly design, ensuring continuous functionality during daylight hours.

IR Sensor

An IR (Infrared) sensor is a device that detects infrared radiation, often used for proximity sensing and obstacle detection. In the Smart Seed Sowing Robot system, the IR sensor plays a crucial role in enhancing the robot's navigation capabilities by detecting obstacles in its path. When the sensor identifies an object, it sends a signal to the ESP32 microcontroller, which processes the information and adjusts the robot's trajectory to avoid collisions. This obstacle detection capability improves the robot's efficiency and reliability in navigating diverse terrains, ensuring smooth operation while sowing seeds and irrigating the field

Battery

The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radios.

V. RESULTS AND DISCUSSION

The expected outcomes of a proposed solar seed sowing system can be quite impactful, especially in agricultural settings. Here are some key points to consider: 1. Increased Efficiency: Automating the seed sowing process with solar power can significantly reduce labor costs and time, allowing farmers to cover larger areas more quickly. 2. Sustainability: Utilizing solar energy minimizes reliance on fossil fuels, promoting eco- friendly farming practices and reducing the carbon footprint of agricultural operations. 3. Cost Savings: Over time, the

IRJMETS
e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

initial investment in solar technology can lead to reduced energy costs and lower operational expenses, enhancing overall profitability for farmers. 4. Precision Sowing: The system can be designed to ensure precise seed placement, which can lead to better crop yields and reduced seed wastage. 5. Accessibility: For farmers in remote or off-grid areas, a solar-powered system can provide a reliable solution for seed sowing, improving access to modern agricultural practices. 6. Scalability: The system can be adapted for different scales of farming, from smallholder farms to larger agricultural operations, making it versatile.7. Data Collection: Integrating technology with sowing systems allows for data collection on soil conditions, weather patterns, and crop performance, which can inform better farming decisions. 8. Community Impact: By improving farming efficiency and productivity, the system can contribute to food security and enhance the livelihoods of farming communities.

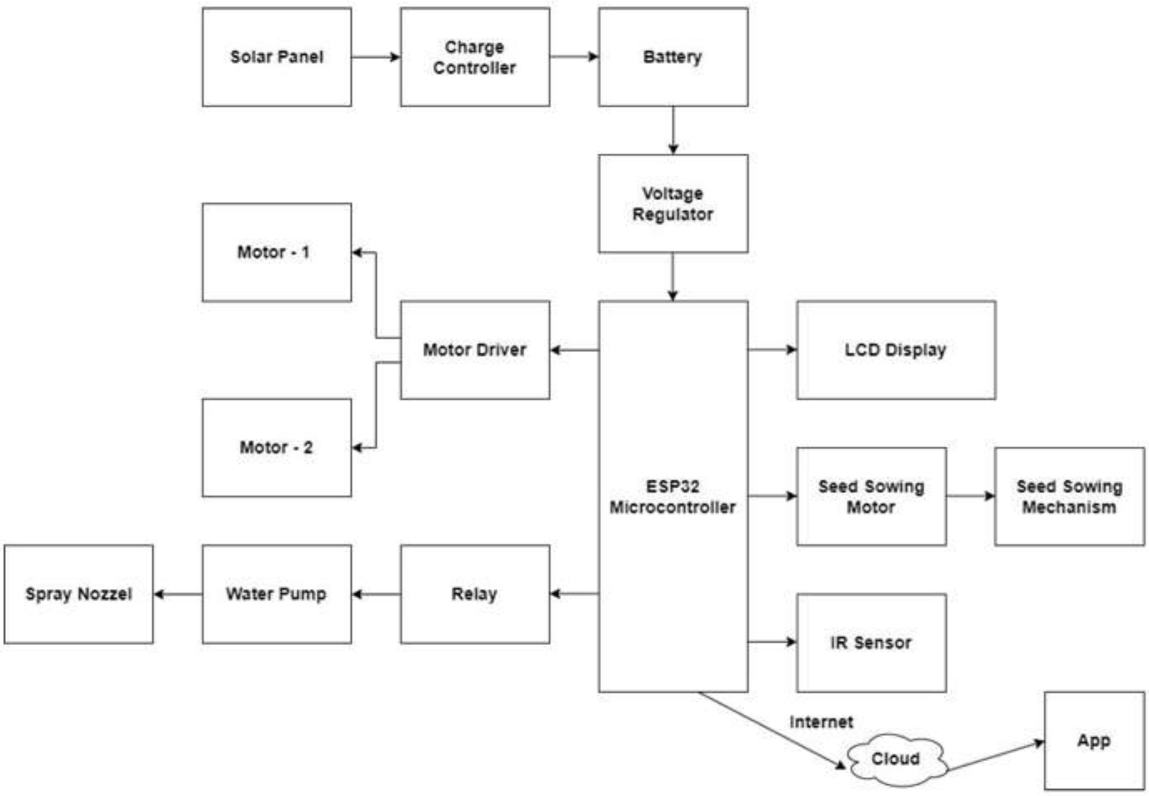

Figure: Block Diagram Of Solar Seed Sowing System

VI. CONCLUSION

The solar seed sowing system represents a significant advancement in sustainable agriculture, leveraging renewable energy to support efficient planting processes. The integration of solar power enables the system to operate autonomously in fields, often in remote areas where access to electricity is limited. Solar-powered mechanisms can drive essential sowing operations, such as dispensing seeds at regular intervals and maintaining accurate spacing, without relying on traditional fuel sources.

This technology enhances productivity by reducing the labor and time needed for planting, promoting precision agriculture practices that improve crop yields. Additionally, it minimizes greenhouse gas emissions and reduces the carbon footprint of farming activities. The system also opens up possibilities for remote monitoring and control, further optimizing planting schedules based on environmental data.

In conclusion, a solar seed sowing system offers a cost-effective, environmentally friendly, and efficient solution for modern agriculture, contributing to sustainable farming practices and helping meet global food demands.

VII. REFERENCES

[1] D.S. Rahul, S.K. Sudarshan, K. Meghana, K.N. Nandan, R. Kirthana, P. Sure. IoT based solar powered Agribot for irrigation and farm monitoring: Agribot for irrigation and farm monitoring. Proceedings of the 2nd International Conference on Inventive Systems and Control, 2018, 826–8.

[2] M. Aravind Kumar, A.S. Reddy, K. Sagadevan, Automatic seed sowing & irrigation agribot using arduino, Int. J. Pure Appl. Math. 119 (2018), 1089–1092.

[3] Design and fabrication of manually operated seed sowing machine R. Kathiravan, P. Balashanmugam Volume: 06 Issue: 06 | June 2019

[4] Umed. Ali Soomro, Mujeeb Rahman, Ejaz Ali Odhano, Shereen Gul, Abdul Qadir Tareen "Effects of sowing Method and Seed Rate on Growth and yield of wheat" World Journal of Agricultural Sciences 5(2):159-162.

[5] Prof. Ayane swapnil1, Bhor Rajashri A.2, Madane Kajal A.3 Assistant Professor, Dept. of E&TC Engg, PCCOE, Pune, India1 Dept. of E&TC Engg, PCCOE, Pune, India 2, 3 (Agricultural Robot for Automatic Seeding

[6] Vidya Yedave, Punam Bhosale, Jyoti Shinde, Prof. Jagdish Hallur, "Automatic Seed Sowing Robot", International Research Journal of Engineering and Technology (IRJET), Issue: 04 April 2019.

[7] Bhise Sanket Sunil, D.B. Kadam, Kore Vinit Vikas, Kolekar Arun Anand, "Automatic Seed Sowing Robot", Journals of Advancement in Electronics Design Volume 3 Issue

[8] Avula Likhitha, B.Mamatha, Agamanti Sai Kirn, Dondeti Pranitha, "IOT Based smart agriculture and automatic seed sowing robot, Issue: 02/2020.

[9] Prajith A S, Nowfiya B S, Nadeem Nowshad, Muhammad Ashik S, Subi S, Dhinu lal M "Automatic Agricultural Robot – Agrobot", 2020 IEEE