Multiseed Sowing Machine Using Android App and Solar Panel

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Abstract-

In traditional method of agricultural works, the equipment used to perform above operations are expensive and inconvenient to handle. So, farmers need advance technologies to perform agricultural processes.

The purpose of this work is to design and develop the robot which can perform operations like Seed Sowing, Water Sprinkling. This robot gets power supply from solar panel, so it does not need any external power supply. The whole system is controlled by android application using Bluetooth interfacing with Arduino UNO which sends the signals to the robot for required mechanisms and movement of the robot. The plantation of seeds is automatically done by using dc motor. Constant distance is maintained for sowing of seed. Sprinkler is used to provide water to crop. It has rotating nozzles to sprinkle the water on crop

This robotic vehicle will minimize the labor cost, increase the speed and accuracy of the work. It includes multiple operations, so it is cost effective. Energy required for this machine is less as compared with tractors or other agricultural instruments like electric pumps.

Keywords-

Solar Panel, Dc Pump, Bluetooth Module, and Arduino UNO, DC Geared Motor.

I. INTRODUCTION

In India there are 70 percentage of population chooses agriculture as a primary occupation. In the current generation we do not have sufficient skilled manpower specifically in agricultural sector. A manual farming consumes more time& leads to more population. The main purpose for developing Automation in Agricultural field is decreasing labor and decreasing time required to perform the processes on crops so that human efforts will get reduce up to 90 percent. Automation is required for safety and health of workers especially when worker have to perform harmful duties.

In recent years, agriculture has seen significant advancements with the introduction of smart technologies that aim to increase productivity, reduce labor costs, and optimize resource use. One such innovation is the Multiseed Sowing Machine integrated with an Android App and powered by a Solar Panel**.** This machine addresses the pressing need for efficient and precise seed sowing, which is a fundamental aspect of modern farming. The traditional methods of sowing seeds can be time-consuming and labor-intensive, often leading to uneven seed distribution and lower yields. The Multiseed Sowing Machine is designed to overcome these challenges by automating the sowing process with the help of smart technology.

The system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module and Arduino UNO Controller. The whole process is controlled by microcontroller. The solar panel is used to charge the battery. This battery

used to power vehicle movement as well as to the motor that is used for Plantation of seed. Distance between the two seeds are controlled and varied by using Microcontroller. When the robot reaches the end of the field, we can change the direction with the help of Bluetooth command. The advantage of this solar powered multi-function Agri-robot is that it does not require any fuel or petrol to work, as it works on the solar energy. The circuit model is less complex and compact due the use of Arduino controller.

II. LITERATURE SURVEY

1. Automated Seed Sowing Agribot using Arduino: The Automated Seed Sowing Agribot developed by Saurabh Umarkar and Anil Karwankar is an innovative project aimed at automating the seed sowing process in agriculture. By utilizing Arduino-based technology, the system can reduce manual labor, increase sowing precision, and improve overall agricultural efficiency. Here's a summary of the proposed methodology and system components for this kind of project, based on common approaches used in similar seed sowing robots In "Automated Seed Sowing Agribot using Arduino",

2. Design and Implementation of Seed Sowing Agricultural Robot: To create a prototype of Seed Sowing Agricultural Robot which is used to drill a hole in the prescribed field at defined spaces between them and sow the seeds automatically in to the digged hole. In **"**Design and Implementation of Seed Sowing Agricultural Robot", Pradeep Gorre in March 2017.

3. Autonomous seed sowing agricultural robot: In "Autonomous seed sowing agricultural robot", P. V. S. Jayakrisna, et.al, discussed that the robot capable of performing operations like automatic seed sowing. It also provides manual control when required. It checks the humidity with the help of humidity sensors. The main component here is the AVR at mega microcontroller that controls the entire process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously sowing seeds side by side. . Disadvantage of this robot is on the field the robot operates on automated mode, but outside the field is strictly operated in manual mode.

4. GPS based Autonomous Agriculture Robot: In "GPS based Autonomous Agriculture Robot" developed by S. Kareemulla et.al, the system benefits farmers by performing basic operation of seed sowing. This machine's operation 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 sowing operation.

III. PROPOSED METHODOLOGY

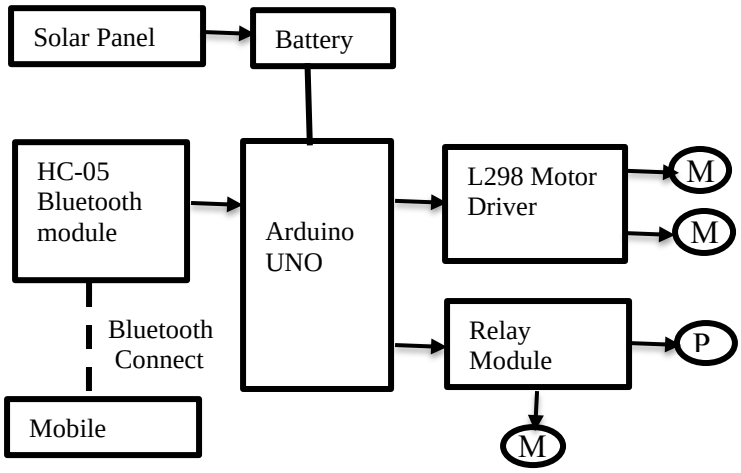

Fig.2. Block Diagram of automatic seed sowing using android app & solar panel.

Step 1: System Components

1. Hardware Components:
   - Arduino UNO: The central controller for managing the seed sowing process, controlling actuators, and interacting with

     Sensors.
   - Solar Panel: Provides renewable energy to power the system, including the Arduino and other components.
   - Battery: Stores the energy generated by the solar panel.
   - Seed Dispensers: Mechanism to dispense multiple seed types
   - Motors: For moving the machine, controlling the sowing depth, and operating the seed dispensers.

- Bluetooth (HC-05): For communication between the Android app and Arduino.

2. Software Components:
   - Arduino Code: To program the Arduino to handle all logic related to seed dispensing, navigation, and sensor integration.
   - Android App: User interface for controlling the machine, configuring parameters, and monitoring data.

Step 2: Initialization and system setup

1. Solar Power Initialization:
   - The solar panel is responsible for charging the battery connected to the Arduino UNO, motors, and other components. The solar panel ensures that the system can operate continuously in outdoor environments without relying on the power grid.

2. Hardware Setup:
   - Connect the Arduino UNO to motors, seed dispensers, sensors, and communication modules (Bluetooth) for seamless data exchange.
   - Seed Dispensers: The system uses different seed containers, each equipped with a motor to release seeds based on user input. Different seed types can be controlled by activating the respective solenoid.
3. App Setup:
   - The user installs and configures the Android app to communicate with the Arduino via Bluetooth or Wi-Fi.
   - The app interface allows the user to set parameters such as seed type, sowing depth, row spacing, and other conditions before starting the sowing process.

Step 3: Configuration via Android App

1. Connect App to Arduino:
   - Open the Android app and establish a Bluetooth connection with the Arduino UNO.
   - The app interface displays options to:
     - Choose seed type (e.g., maize, wheat, etc.).
     - Set sowing depth and row spacing.
     - Set sowing time and schedule.

Step 4: Start the Automated Sowing Process

1. Sowing Machine Movement:
   - After receiving parameters from the app, the Arduino begins controlling the motors to move the sowing machine across the field using a pre-programmed path.
2. Seed Dispensing Control:
   - Multi-seed dispensers (connected to motors) are controlled by the Arduino to dispense the correct seed at the appropriate time:
     - The seed dispenser releases seeds at a set distance, ensuring proper spacing between each seed.
     - The depth control system adjusts the sowing mechanism to ensure the seeds are placed at the correct depth.

Step 6: System Shutdown

1. Shutdown Procedure:
   - Upon completion of tasks or on command, stop all operations.
   - Deactivate communication modules and android app.
   - Power down the Multiseed sowing machine system.

IV DESIGN METHODOLOGY

Designing a Multiseed Sowing Machine using an Android App and Solar Panel is an Innovative approach that combines precision farming, automation, mobile technology, and sustainable energy.

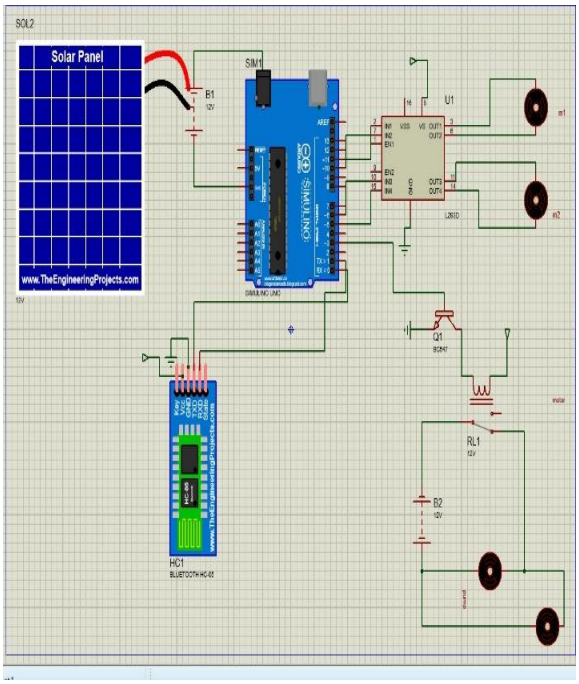

Fig 1: -Circuit Diagram of Multiseed sowing machine

V. HARDWARE REQUIREMENT

In this project, The Arduino UNO is the main controller that makes all the decisions such as seed sowing, water sprinkling and movement of the robot. The Bluetooth HC-05 is used for the interfacing between android app and controller. The basic elements required for this project are listed below

- Solar Panel
- Arduino UNO
- Bluetooth module HC-05
- Battery
- DC Geared Motor
- Relay Module
- L298 Motor Driver

VI. SOFTWARE FRAMEWORK

1. Set up Your Arduino Environment

Before you start writing your Arduino code, ensure you have the following:

Arduino Board: An Arduino Uno, Nano, or any other model.

Arduino IDE: Download and install the Arduino IDE if you haven't already.

Connection: Connect your Arduino to the computer via USB.

2. Create a New Sketch

3. Understand the Structure of the Arduino Program

4. Define Pins and Variables

5. Write Setup Code

6. Write Loop Code

7. Upload the Program to Your Arduino

8. Test and Debug

9. Final Testing

VIII. RESULTS

- Increased efficiency in seed planting.
- Cost savings through solar power and reduced reliance on fuel.
- Improved yield through precise control and adjustments from the Android app.
- Sustainability in operations, especially for off-grid areas.
- Positive environmental impact by reducing carbon emissions.

IX. FLOW CHART

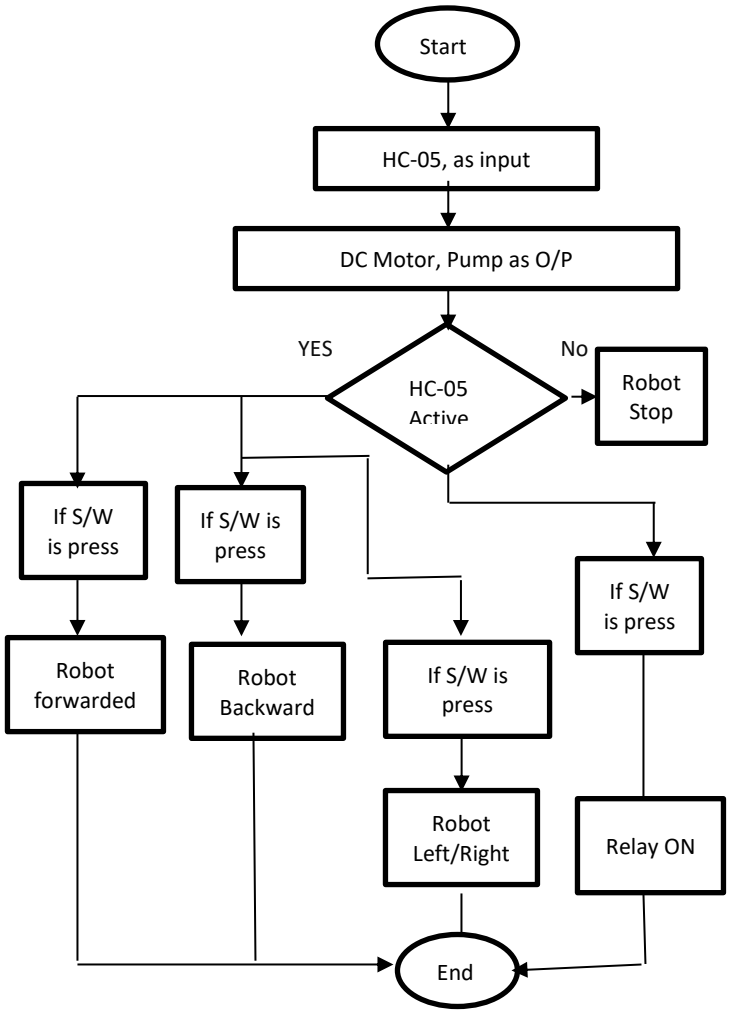

Fig 2 –Flow Chart

X. APPLICATIONS

Applications of Multi-Seed Sowing Machine Using Android App and Solar Panel

1. Precision Agriculture
   - Optimized Seed Placement: The multi-seed sowing machine, powered by Arduino, ensures precise seed placement at the correct depth and spacing. This enhances seed germination rates, reduces seed wastage, and improves crop yield.
   - Automated Adjustments: Using the Android app, the farmer can adjust sowing parameters, such as row spacing, depth, and sowing speed, based on crop type. This level of control ensures that each seed type is planted under optimal conditions, improving overall crop productivity.
   - Soil Condition Monitoring: The integration of soil moisture sensors allows the system to monitor real-time soil conditions. The machine can adjust its sowing patterns based on the soil moisture content to ensure optimal planting time and conditions, improving resource efficiency.
2. Sustainable Farming
   - Solar-Powered Operations: The solar panel makes the system self-sustaining by charging the machine's battery during the day. This reduces dependency on external power sources, making the system ideal for off-grid or rural areas with unreliable electricity supply.
   - Energy Efficiency: The solar-powered system contributes to reducing the environmental impact of farming by promoting the use of renewable energy, which is crucial for sustainable agricultural practices.
   - Low Carbon Footprint: Since the system operates without relying on fossil fuels, it minimizes greenhouse gas emissions, contributing to environmentally-friendly farming.
3. Multi-Crop Planting
   - Simultaneous Planting of Different Seeds: The machine can plant multiple types of seeds simultaneously by controlling different dispensers for each seed type. This is particularly useful for farmers practicing crop rotation or growing complementary crops (e.g., legumes with cereals) in the same field.

- Increased Yield: By enabling efficient multi-seed sowing, farmers can maximize land use, improve biodiversity, and potentially increase the overall yield of crops.

XI. CONCLUSION

This Robot will be basically designed for the Agricultural field. This will help farmers for Sowing Seeds, Water Sprinkler which reduce the human efforts and work is done simultaneously as per the requirement. This will be the low cost machine, which will be easy to handle. By using solar energy, battery is charged and work can be done as per the command. It also helps farmers to reduce the Labour cost. By the use of machineries in this field save time, increase efficiency and indirectly increase the production in farms.

REFERENCES

1. Saurabh Umarkar and Anil Karwankar In "Automated Seed Sowing Agribot using Arduino", International Conference on Communication and Signal Processing (ICCSP), November 2016.
2. P. V. S. Jayakrisna In "Autonomous seed sowing agricultural robot", International Conference on Advances in Computing, Communications and Informatics (ICACCI), September 2018.
3. S. Kareemulla in "GPS based Autonomous Agriculture Robot" International Conference on Design Innovations for 3Cs Compute Communicate Control (ICDI3C), April 2018
4. Pankaj Kumar in "Design and fabrication of smart seed sowing robot", August 2020.

Books

1. Arduino for Beginners: Essential Guide to Arduino Programming

   It provides the foundational knowledge you need to develop, program, and troubleshoot your system.
2. Arduino Robotics by John-David Warren, Josh Adams, and Harald Molle

   The book's hands-on approach will give you practical skills in motor control, sensor integration, autonomous navigation, and wireless communication all of which are essential for your project

Industry Standards

1. **ISO 14001:2015 – Environmental management systems — Requirements with guidance for use**
   - This standard helps ensure that the system is designed with sustainability in mind. Since the project uses solar energy, implementing ISO 14001 will guide the design of an environmentally-friendly system, with minimal negative environmental impact.

2. **ISO/IEC 12207:2017 – Software life cycle processes**
   - This standard outlines the processes for software development and maintenance. For your Android app and Arduino code, this standard provides guidelines for the software development lifecycle, ensuring that the software is developed and maintained in a structured and efficient manner

Online Resources and Websites

1. Arduino Official Website (for tutorials, documentation, and community discussions):
   - https://www.arduino.cc
2. Android Developers Official Site (official documentation for building Android apps):
   - https://developer.android.com
3. Solar Power World (guides and news on solar energy, including solar panel selection):
   - https://www.solarpowerworldonline.com
4. ISO Standards for Agricultural Machinery (safety and performance standards for machinery like seeders):
   - https://www.iso.org/standard/67092.html