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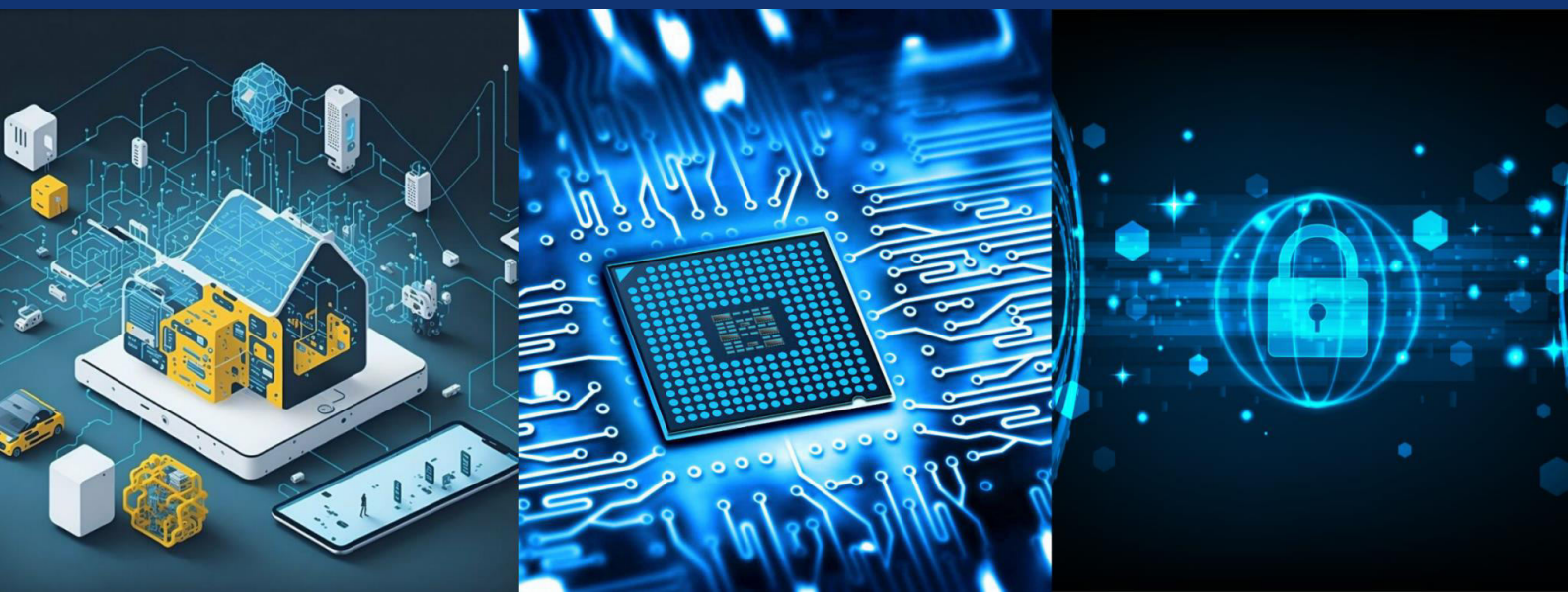

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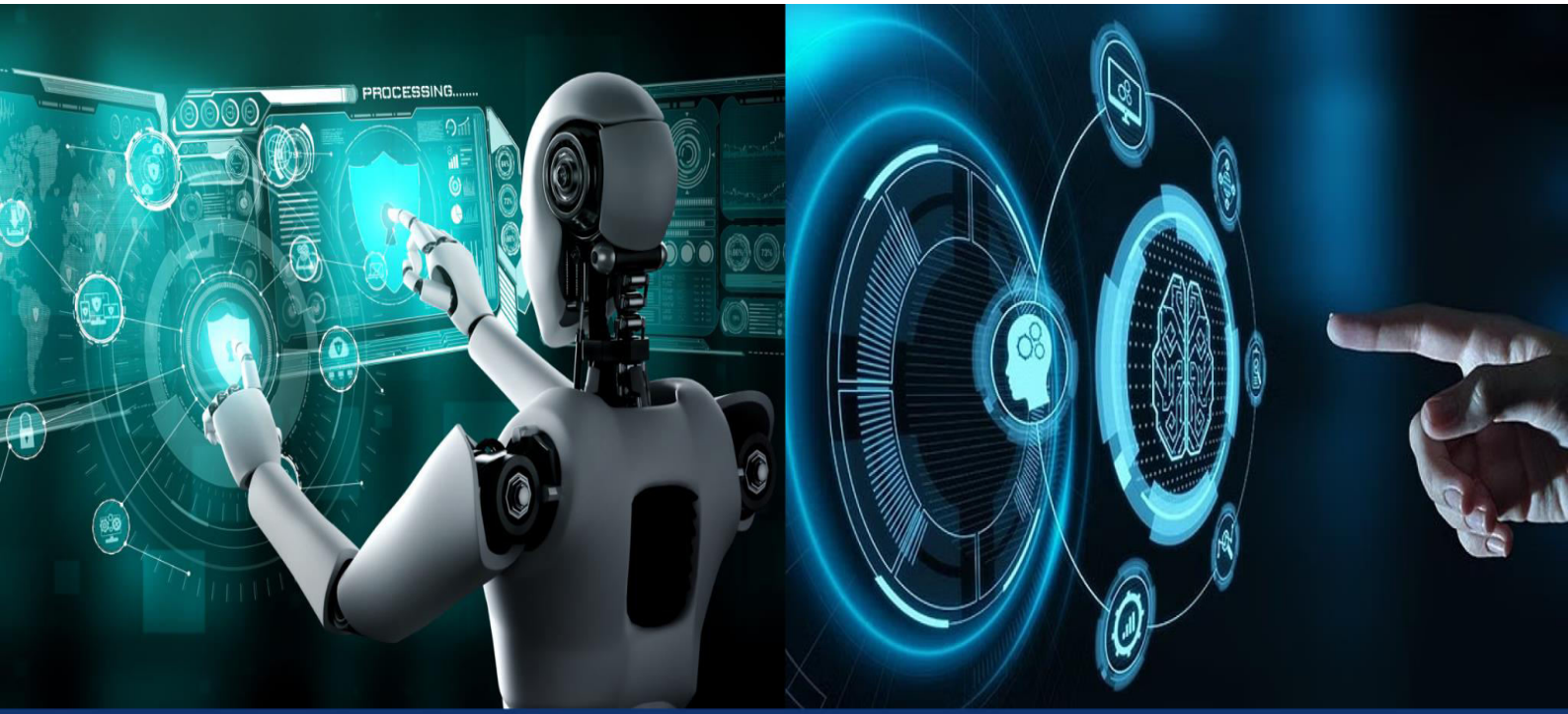

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Solar Pawered Pesticide Sprayer Robot with Seed Sowing

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ABSTRACT: The Solar Powered Pesticide Sprayer Robot with Seed Sowing is an automated agricultural machine designed to reduce human effort and improve farming efficiency. This robot operates using solar energy, making it eco-friendly and cost-effective. The system is equipped with a pesticide spraying mechanism and a seed sowing unit that allows farmers to perform two important agricultural tasks simultaneously. Solar panels convert sunlight into electrical energy, which powers the motors and control system of the robot. The robot moves across the field and sprays pesticides evenly while sowing seeds at proper intervals. This helps in reducing labor cost, saving time, and minimizing farmers' exposure to harmful chemicals. The proposed system is especially useful for small and medium-scale farmers and promotes sustainable and smart farming practices.Agriculture is the backbone of many developing countries, and farmers often face challenges such as labor shortage, high operational costs, and health risks due to exposure to pesticides. To overcome these problems and improve farming efficiency, the Solar Powered Pesticide Sprayer Robot with Seed Sowing system is designed. This project focuses on developing an automated agricultural robot that performs two important farming operations: pesticide spraying and seed sowing.

The proposed system uses solar energy as the primary power source, making it environmentally friendly and cost-effective. Solar panels mounted on the robot convert sunlight into electrical energy, which is stored in a rechargeable battery. This stored energy is used to operate the motors, control unit, and spraying mechanism of the robot. The robot is designed to move across agricultural fields and carry out operations with minimal human intervention.

The seed sowing mechanism is designed to place seeds at regular intervals and at an appropriate depth in the soil, which helps in proper plant growth and improves crop productivity. At the same time, the pesticide spraying unit ensures uniform distribution of pesticides over crops, helping to protect them from pests and diseases. This reduces the manual effort required from farmers and minimizes direct exposure to harmful chemicalsThe system can be controlled easily and is suitable for small and medium-sized farms. By integrating renewable energy and automation in agriculture, this robot helps reduce labor costs, save time, and increase efficiency in farming operations. The Solar Powered Pesticide Sprayer Robot with Seed Sowing represents a step toward modern smart farming and sustainable agricultural practices..

KEYWORDS: Solar Energy, Agricultural Robot, Pesticide Sprayer, Seed Sowing Mechanism, Automation in Agriculture, Renewable Energy, Smart Farming, Motor Control System, Sustainable Agriculture, Farm Mechanization.

I. INTRODUCTION

Agriculture plays a vital role in the economy of many countries, especially in developing nations like India. Farmers depend on various agricultural practices such as seed sowing, pesticide spraying, and crop maintenance to achieve better crop production. However, traditional farming methods require a large amount of manual labor, time, and effort. In addition, farmers often face health risks due to direct exposure to harmful pesticides during spraying. With the advancement of technology, automation and robotics are increasingly being used in agriculture to improve efficiency and reduce human effort. The Solar Powered Pesticide Sprayer Robot with Seed Sowing is an innovative solution designed to perform two essential agricultural operations simultaneously. This robot uses solar energy as its main power source, making it environmentally friendly and cost-effective.

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The system consists of a solar panel, rechargeable battery, motor-driven wheels, pesticide spraying unit, and a seed sowing mechanism. The solar panel converts sunlight into electrical energy, which powers the robot and its components. As the robot moves across the field, it sprays pesticides uniformly on crops while sowing seeds at regular intervals. This helps in improving crop growth, reducing labor costs, and increasing overall farming productivity. The system consists of a solar panel, rechargeable battery, motor-driven wheels, pesticide spraying unit, and a seed sowing mechanism. The solar panel converts sunlight into electrical energy, which powers the robot and its components. As the robot moves across the field, it sprays pesticides uniformly on crops while sowing seeds at regular intervals. This helps in improving crop growth, reducing labor costs, and increasing overall farming productivity.

This project promotes the use of renewable energy and automation in agriculture, making farming smarter, safer, and more efficient. It is especially beneficial for small and medium-scale farmers who need affordable and effective agricultural solutions.

II. LITERATURE SURVEY

Many researchers have worked on agricultural automation using robots and renewable energy to reduce human effort and improve farming productivity.

Ravikumar H. M. et al. (2023) developed a solar agricultural sprayer robot that helps farmers spray pesticides automatically. The robot reduces manual labor and minimizes excessive pesticide use by applying chemicals directly to crops. The system is powered by solar energy and uses motors and control mechanisms to move across the field efficiently. Research on solar-powered agricultural robots shows that integrating solar panels with farming robots provides a clean and renewable power source. Such robots can perform activities like sowing, spraying, monitoring crops, and weed control, contributing to sustainable and smart farming systems.

Sheetal Patted et al. (2024) proposed a solar-powered automated multitasking agricultural robot capable of performing operations such as seed sowing, pesticide spraying, and water sprinkling. Their research highlighted that automation in agriculture can reduce manpower requirements, save time, and improve overall farming productivity.

Arjun Chaudhary et al. designed a smartphone-operated multipurpose agricultural robot powered by solar energy. The robot performs multiple activities including pesticide spraying, irrigation, and seed sowing. The system demonstrates how combining robotics and renewable energy can improve efficiency in agricultural tasks. matjournals.co.in

Another study on a solar-operated smart multifunctional agribot introduced wireless control and obstacle detection using ultrasonic sensors. The robot could spray chemicals and perform basic agricultural operations while reducing farmers' exposure to harmful pesticides and lowering operational costs S. V. Raut et al. proposed a robotic vehicle for pesticide spraying in agriculture that helps farmers spray chemicals uniformly over crops. The system uses a motor-driven mechanism and spraying pump to distribute pesticides effectively. Their research concluded that automated sprayers reduce manual labor and improve spraying accuracy in agricultural fields.

K. K. Patel et al. developed a seed sowing robot designed to plant seeds at a fixed distance and proper depth in soil. The machine uses a mechanical seed dispensing system connected to rotating wheels. Their study showed that automated seed sowing improves crop spacing and increases agricultural productivity

III. METHODOLOGY

The methodology of the Solar Powered Pesticide Sprayer Robot with Seed Sowing involves the design, development, and implementation of an automated agricultural system that performs pesticide spraying and seed sowing using solar energy. The system is developed through several stages including design, component selection, fabrication, and testing.

First, the overall structure of the robot is designed. The robot consists of a metal or plastic chassis mounted on wheels that allow it to move across the agricultural field. DC motors are connected to the wheels to provide movement and are controlled through a motor driver circuit.

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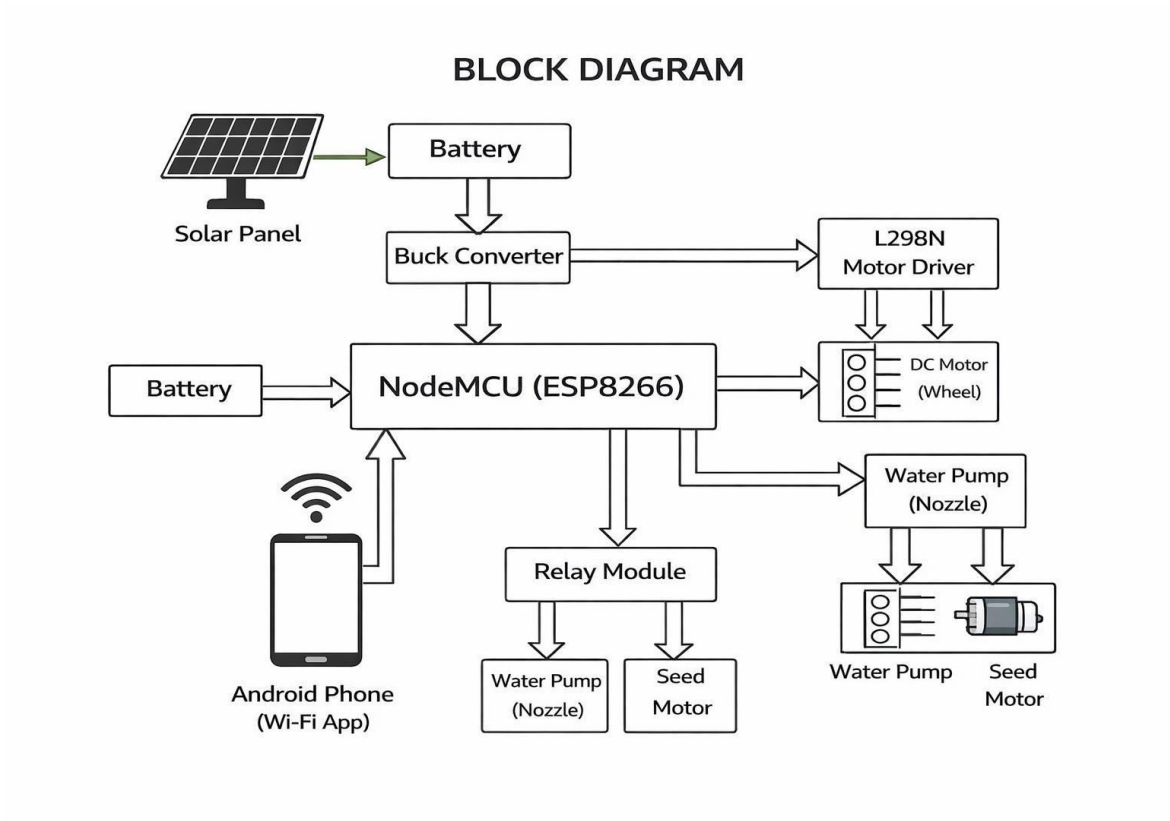
A solar panel is installed on the robot to capture sunlight and convert it into electrical energy. The generated energy is stored in a rechargeable battery, which supplies power to the motors, control unit, and other components of the robot. The seed sowing mechanism is designed to drop seeds into the soil at regular intervals. A seed container is placed on the robot, and a rotating mechanism or dispenser allows seeds to fall into the soil as the robot moves forward. This helps maintain proper spacing between seeds and ensures uniform crop growth.

The pesticide spraying unit consists of a small tank, pump, and spraying nozzles. The pump draws pesticide from the tank and sprays it evenly over the crops while the robot moves through the field. This ensures proper distribution of pesticide and reduces wastage. The control system manages the movement of the robot and the operation of the spraying and seed sowing mechanisms. Switches or a simple controller are used to control the robot's functions. Finally, the system is tested in a field-like environment to evaluate its performance. The testing ensures that the robot moves properly, sows seeds at correct intervals, and sprays pesticides evenly. The results show that the robot can reduce manual labor, save time, and improve farming efficient.

IV. EXPERIMENTAL RESULT



The block diagram represents the working system of a solar powered pesticide sprayer robot with seed sowing mechanism.

The solar panel converts sunlight into electrical energy, which is regulated by the charge controller and stored in the battery. This stored energy powers the microcontroller (Arduino/NodeMCU), which acts as the main control unit of the robot.

An Android mobile application sends control commands through the Wi-Fi module (ESP8266) to the microcontroller. Based on these commands, the microcontroller controls different components of the robot. The motor driver operates the DC motors that rotate the wheels, allowing the robot to move in the field.

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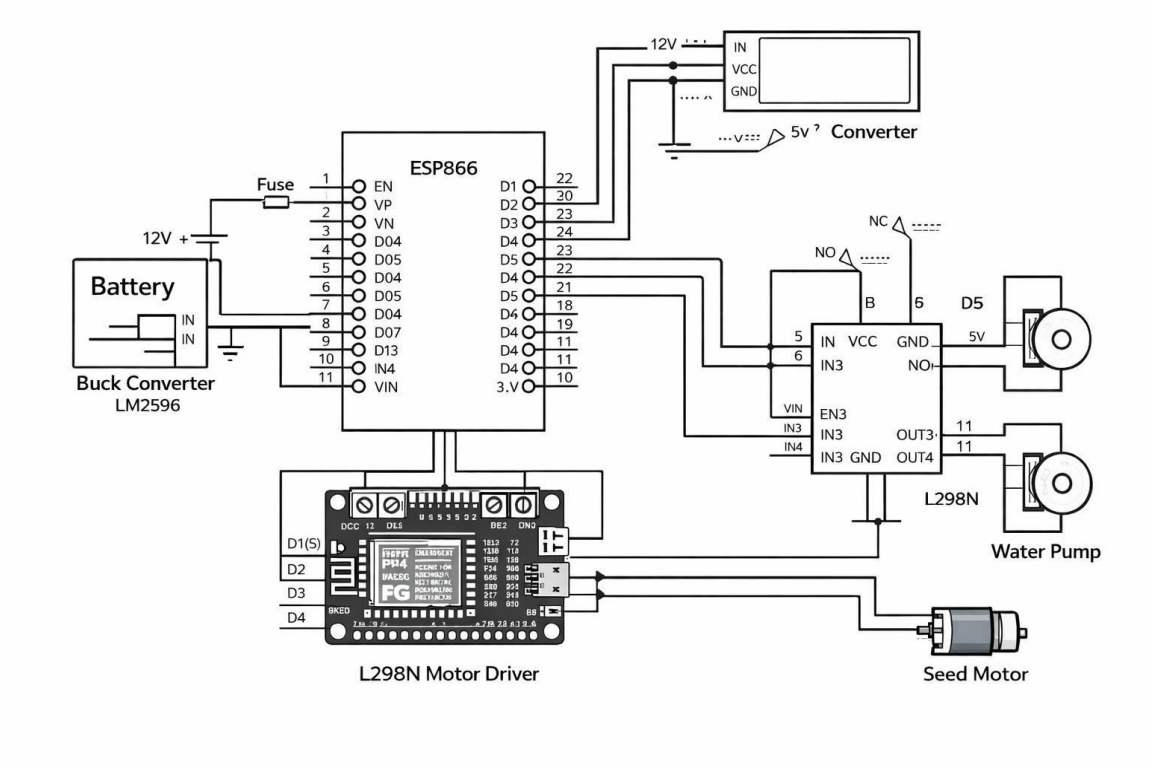
A relay module controls the water pump, which sprays pesticide through the nozzle. At the same time, a seed motor drives the seed dispensing mechanism to drop seeds into the soil at regular intervals.

Thus, the system enables automated movement, pesticide spraying, and seed sowing in agricultural fields using solar energy.



The circuit diagram shows the electrical connections of the solar powered pesticide sprayer robot with a seed sowing system. A battery supplies power to the system, and a buck converter (LM2596) regulates the voltage for the NodeMCU (ESP8266) microcontroller.

The NodeMCU controls the L298N motor driver to operate the DC motors for robot movement. A relay module is used to switch the water pump for pesticide spraying, while a seed motor drives the seed dispensing mechanism.
Thus, the circuit enables controlled movement, pesticide spraying, and seed sowing using the microcontroller.

V. CONCLUSION

The solar powered pesticide Spayer Robot with Seed Sowing project was successfully designed and implemented to perform important agricultural tasks automatically. The system uses solar energy as its main power source, making it environmentally friendly and cost-effective. The robot is capable of moving through the field, sowing seeds at proper intervals, and spraying pesticides evenly on crops.

The experimental results show that the robot operates efficiently and reduces the manual effort required in traditional farming methods. It also minimizes the direct exposure of farmers to harmful pesticides and helps save time and labor. The use of solar power further reduces dependency on conventional electricity or fuel sources.

This project demonstrates how automation and renewable energy can improve agricultural productivity and support modern smart farming practices. In the future, the system can be enhanced by adding advanced technologies such as automatic navigation, IoT monitoring, and additional sensors to increase its efficiency and performance.

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