AGRI ROBOT

Dhanush V S[1], Pavitra Rangannavar [2], Umesha H S [3], Vidya V [4], Mrs. Lathamani H N[5]

Undergraduate Student, Department of Electronics and Communication Engineering, Sampoorna institute of technology and research, Channapatna, Karnataka, India[1,2,3,4]

Assistant Professor, Department of Electronics and Communication Engineering, Sampoorna institute of technology and research, Channapatna, Karnataka, India[5]

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ABSTRACT

The solar based multipurpose agriculture robot is an automated operating system. In ancient days, farming was done using traditional methods. Traditional methods consume a lot of manual effort and require more power and time. But using a smart agriculture robot saves time and power and also reduces human effort.in the solar-based multipurpose agriculture robot, the main function are: (I) Grass cutting, (II) water spraying and pesticide spraying, and (III) seed sowing. In this robot, the operation are performed automatically. The grasscutter, water sprayer and pesticide sprayer, seed sowing robot use solar energy. Solar energy is a renewable source, unlike conventional energy sources. In our country, sunlight is abundantly available. The solar energy is stored in a battery during the vehicle's movement. The system works automatically, and the action are performed simultaneously.

Keywords: solar energy, motor driver, multipurpose robot, Arduino, ultrasonic sensor, precision irrigation, sprayer machine, cutter machine, Bluetooth controller.

INTRODUCTION

The solar-powered multipurpose agricultural robot plays a vital role in the agricultural field because it performs a significant role in increasing the productivity of the crop yield. India is a country where people are dependent on agriculture as an occupation. So, the farmers face major problems such as water management, carbon footprint, environmental pollution, pest attacks, and crop yield problems. So, to overcome these problems, the invention of a multipurpose agricultural robot has been introduced.

(I) Grass cutter robot: In traditional method of grass cutter works using the minimum required components. It uses a microcontroller to manage the grass cutter and vehicle motors. An ultrasonic sensor is integrated for obstacles detection. In the absence of obstacles, the robot moves forward, backward, right, and left. However, when a obstacles is detection, the ultrasonic sensor stops the grass cutter motor to prevent damage.

(II) pesticide and water spraying: The traditional method of pesticide spraying is harmful chemicals used can cause serious health problems. This project is designed to reduce human exposure to harmful chemicals by using a robotic pesticide system. The System consist of an Arduino circuit, a DC motor, a servo motor, and an ultrasonic sensor. The robotic can move automatically or be controlled manually. It detects obstacles using the ultrasonic sensor and changes its direction to avoid collisions. The robot sprays pesticides effectively while reducing direct human contact with harmful chemical. The improves safety and increase The efficiency of pesticide spraying

(III) Seed Sowing Robot: The automated seed sowing robot helps farmers perform seed sowing efficiently and accurately. The robot uses an Arduino Uno, a motor driver, a DC motor, and a servo motor. It also includes a Bluetooth module for wireless communication. The robot can be controlled using a mobile application through Bluetooth. The system reduces manual labor, saves time, and ensures uniform seed placement. This project provides an effective solution for improving agricultural productivity while reducing the effort required from farmers.

LITERATURE SURVEY

[1] R. Kumar et al.(2021) proposed a solar-powers seed sowing robot using an arduino controller and DC motors. The robot automated seed sowing with manual navigation. The major limitation was that it performed only a single agricultural operation and lacked and IoT-based monitoring.

[2] S. Patil et al. (2022) developed an IoT-based smart irrigation system using soil moisture sensors and ESP32. The system automatically controlled irrigation based on soil conditions. however, it was limited to irrigation and did not support other farming operations.

[3] A. Sharma et al. (2021) presented a smart crop monitoring system that measured temperature, humidity, and soil moisture field conditions remotely. The system did not include robotic automation for field activities.

[4] M. Singh et al. (2020) designed an autonomous pesticide spraying robot using ultrasonic sensors for obstacle detection. The robot reduced manual spraying effort but was not capable of seed sowing or irrigation.

[5] P. Verma et al. (2022) proposed an AI-based plant disease detection system using image processing and machine learning techniques. The model achieved high disease classification accuracy but was limited to crop health analysis without field automation.

[6] T. Joseph et al. (2024) presented a multi-purpose farming robot capable of irrigation, crop monitoring, and obstacle detection. Although the robot demonstrated improved efficiency, its high implementation cost limited adoption by small-scale farmers.

[7] H. Das et al. (2022) proposed smart greenhouse monitoring system using IoT sensors to regulate environmental conditions automatically. The system enhanced crop growth but was applicable only to greenhouse farming.

[8] K. Reddy et al. (2021) developed an ESP32-based smart farming system for real-time monitoring of soil moisture, temperature, and humidity. The collected data were transmitted through IoT for remote access. The system lacked integrated robotic functionality.

[9] S. Iyer et al. (2023) developed an IoT-enabled agricultural robot for crop monitoring and irrigation control. The system improved water management and remote supervision but did not integrate seed sowing or pesticide spraying.

[10] D. Gupta et al. (2023) introduced a multi-functional agricultural robot capable of seed sowing and pesticide spraying. The robot improved operational efficiency but

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did not provide cloud-based monitoring or intelligent decision-making.

[11] N. Rao et al. (2022) proposed a precision agriculture system using wireless sensor networks for environmental monitoring. The system optimized irrigation scheduling but required fixed sensor installations, reducing field mobility.

METHODOLOGY

Fig13: methodology for multi-purpose agriculture diagram

This robot is designed using many components, such as a solar panel, Arduino, DC motor, Bluetooth module, and other components. The operation of the robot is performed step by step. First, the solar panel is used to generate electrical energy from sunlight through the photovoltaic effect. The solar panel converts solar energy into electrical energy. This energy is then supplied to the robot through a voltage regulator. The voltage regulator provides the required voltage to the different components of the robot. The robot is operated using a microcontroller. The microcontroller controls the DC motors and other components according to the commands given by the user. The robot consists of a DC motor, solar panel, peristaltic pump, and other necessary components. The DC motors help the robot to move in different directions. The pesticide pump is used for spraying or supplying liquid. The robot can be controlled using a Bluetooth module, which helps the user operate the robot wirelessly.

HARDWARE REUIREMENTS

ESP32Microcontroller

fig2: ESP32 Microcontroller

The ESP32 Microcontroller functions as the central controller. It receives information from the connected sensors and controls the movement and agricultural mechanisms according to the programmed conditions.

Ultrasonic sensor

Fig3: Ultrasonic sensor

The Ultrasonic sensor identifies objects in the robot's path buy measuring their distance. This information assists the robot in avoiding obstacles during movement.

Motor driver

Fig4: Motor driver

The motor driver provides the required interface between the ESP32 and DC motors. It allows the controller to regulator the movement of the robot.

DC Motors

Fig5: DC Motors

DC Motors provide locomotion for the robotic platform and drive the wheels according to commands from the controller.

Seed sowing unit

Fig6: Seed sowing unit

This mechanism releases and places seeds into the soil at controlled intervals, supporting automated sowing.

Water pump

Fig7: Water pump

The pump supplies water to the crops when irrigation I triggered according to the soil moisture condition.

Pesticide pump and sprayer

Fig8: Pesticide pump and sprayer

This unit transfers and distributes pesticide over the crop area, reducing the requirement for manual spraying.

Relay module

Fig9: Relay module

The relay provides switching control for electrical loads such as the irrigation and pesticide pumps.

Solar panel, charge controller and battery

Fig10: Solar panel, charge controller and battery

The solar panel generates electrical energy while the charge controller manages charging and the battery stores energy for operating the robot.

Voltage regulator

Fig11: Voltage regulator

The regulator maintains a suitable voltage level for the ESP32, sensors, and other electronic circuits.

Chassis and wheels

Fig12: Chassis and wheels

The chassis provides structural support for the complete system, while the wheel enables the robot to travel through the agricultural field.

SOFTWARE REQUIRMENTS

Arduino IDE

The Arduino IDE is used to write, compile, and upload the embedded program to the ESP32 microcontroller. It provides a convenient environment for configuring sensors, controlling actuators, and implementing the operating logical of the robot.

Protus

Proteus is a software tool used mainly in electronic design automation. The Proteus software is primarily used by electronic design engineers and technicians to create schematics and design circuit boards. The PCB layout is automatically generated from the schematic. This software is also used to check circuit simulations. Circuit simulation software is used to design and test electronic circuits virtually before implementing them on real hardware. It saves time and reduces errors in the design process. It also helps to make projects faster and saves money

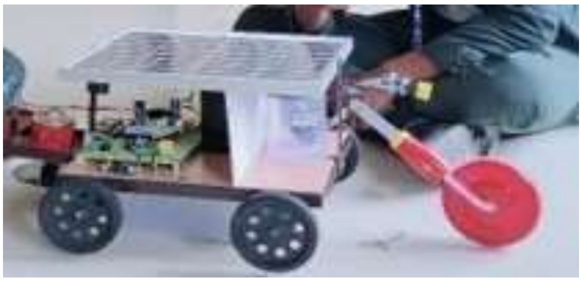
and circuit boards. EAGLE is used to select the required components from a software library. After selecting the components, the connections between them are made to create the circuit. After successfully completing the schematic, the PCB layout can be designed using the software. This software helps engineers check the circuit before implementing it on real hardware. It helps to identify errors in the circuit and makes the design process easier and more reliable. It plays a vital role in designing electronic circuits. EAGLE is a multipurpose tool that helps engineers build and design electronic circuits and PCBs. It saves time, reduces errors, and makes the circuit-design process easier

RESULT AND DISCUSSIONS

This project is helpful to farmers because it reduces human effort and saves time. It reduces water consumption and also uses a renewable energy source. It helps protect the farmer's health. It helps produce good-quality and high-quantity crops.

CONCLUSION

The solar-based multipurpose robot is designed to perform farming activities in a smarter, more efficient, and eco-friendly way. It uses solar energy, which helps reduce the consumption of non-renewable energy. The robot consists of several components, such as an Arduino, DC motors, an ultrasonic sensor, and a motor pump, which play important roles in its operation. It helps reduce labour costs, saves time, minimizes human effort, and reduces the use of pesticides. Overall, this robot provides an affordable and efficient farming solution while improving agricultural productivity.



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