Solar Powered Remote Operated Multipurpose Agricultural Robot

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Abstract

This research paper focuses on the development of a versatile agricultural robot powered by solar energy and operated through an infrared remote control. The robot performs various tasks in the agricultural field, including soil plowing, seed planting, grass cutting, and crop watering. By harnessing the renewable resource of solar energy, this robot technology offers significant cost and time savings for farmers. The system converts solar power into electrical energy using solar panels, which is then stored in a rechargeable battery. The robot comprises essential components such as a microcontroller (Atmega328), motor driver (L298N), gear motors, water pump, grass cutter, lead-acid battery, and solar panel. The use of an infrared remote control allows farmers to operate the robot conveniently.

Introduction

This paper addresses the challenges faced by Indian farmers, such as labor scarcity and time-consuming traditional farming methods. The integration of robotic technology in agriculture has the potential to reduce labor costs, working hours, safety risks, and environmental impacts. Robotic automation offers enhanced productivity in farming operations, including plowing, seed sowing, grass cutting, and crop watering. These operations are powered by a combination of battery and solar energy. The robot is controlled through an infrared remote control, enabling easy operation for farmers.

Seed Sowing Operation:

The traditional method of seed sowing based on assumptions of seed spacing and depth placement is inefficient and labor-intensive. To address this, the developed robot automates the seed sowing process, eliminating the need for manual labor and reducing strain on farmers.

Grass Cutting Operation:
Unwanted grass is cut using a high RPM DC motor with a stainless-steel blade attached to the bottom of the robot. This automated process ensures efficient grass cutting without manual effort.

Plant Watering Operation:
The robot includes a designed water sprayer using a mini water pump powered by a 12-volt DC supply. This mechanism facilitates automated watering of crops, eliminating the need for manual labor.

Materials and Methodology

The hardware components used in the robot system are as follows:

A. <u>DC 12 V Gear Motors:</u> These motors produce high torque while maintaining low horsepower, making them suitable for various applications in robotics.

Figure 1: DC 12 V Gear Motors

B. <u>Motor Driver L298N</u>: This integrated circuit is a high-voltage, high-current dual full-bridge driver designed to drive inductive loads such as motors, relays, and solenoids.

Figure 2: Motor Driver L298N

C. Solar Panel: A set of interconnected solar photovoltaic modules that generate electricity from sunlight. The solar panel provides a renewable energy source for powering the robot.

Figure 3: Solar Panel

D. IR Remote & Receiver: The infrared remote control serves as the input device for operating the robot, and the IR receiver sensor detects the signals from the remote control.
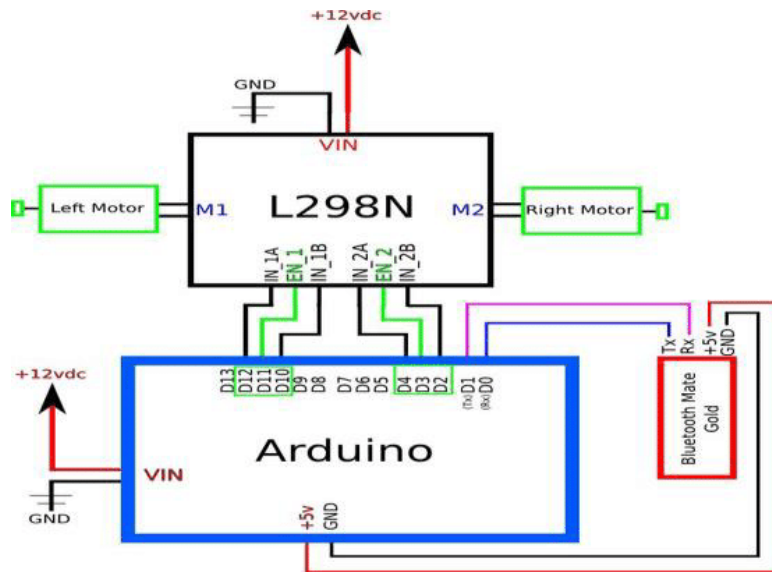
Figure 5: IR Receiver

E. <u>Microcontroller Atmega328:</u> The microcontroller acts as the central control unit for the robot, receiving signals from the IR receiver and generating commands to control various robot operations.

Figure 6: Microcontroller Atmega328

Software Description (Arduino IDE):

The Arduino IDE is used for writing and compiling the code for the robot. It provides an easy-to use platform for programming the microcontroller and uploading the code to the Arduino module. The IDE supports both C and C++ languages and offers debugging, editing, and compilation features
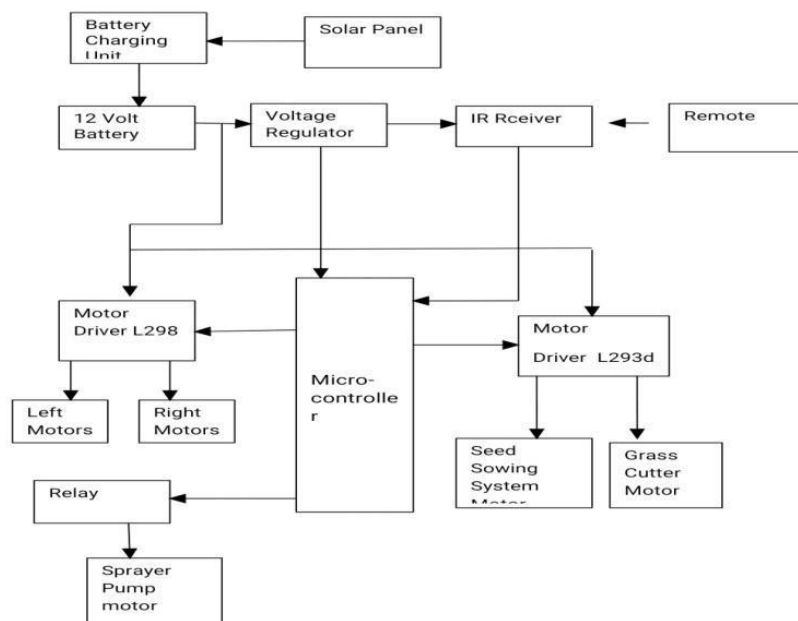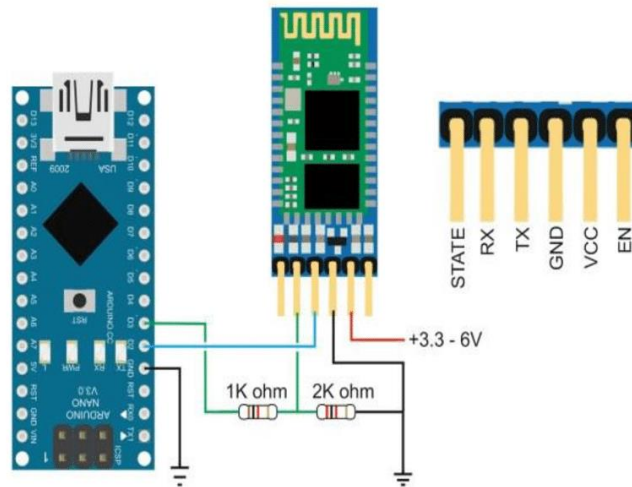

Figure 7: Arduino IDE Block Diagram

Results

The images of final implementation of robot as below,

Operation of the Robot: The robot's operation is based on signals received from the IR receiver sensor via the IR remote control. These signals are decoded by the microcontroller, which generates commands to control the robot's various operations. The solar panel collects sunlight and converts it into electrical energy, which is stored in a lead-acid battery. This stored power is then utilized to power the robot's motors and other components.
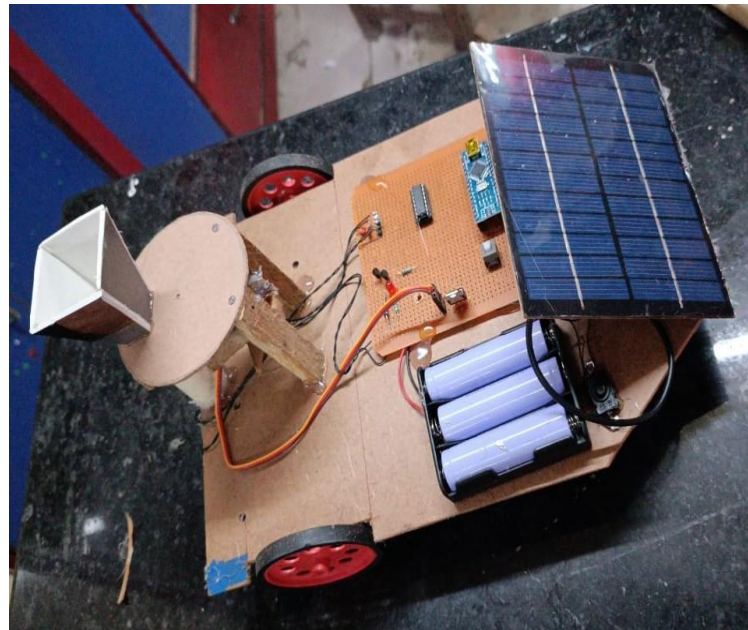
Conclusion

The solar-powered agricultural robot presented in this research paper offers significant benefits for farmers, reducing their efforts and time investment. The automation provided by this robot minimizes the need for manual labor and improves the efficiency of farming operations. By addressing the labor scarcity issue, this technology contributes to the advancement of Indian agriculture. Future developments could involve integrating programmable logic controllers (PLC) and supervisory control and data acquisition (SCADA) systems for full automation.

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