

Multi Functions Agriculture Car

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Introduction

Agriculture is one of the most essential sectors supporting human life, but it continues to rely heavily on manual labour for tasks such as soil monitoring, irrigation, seeding, and grass cutting. With the rapid advancement of automation and robotics, these repetitive and time-consuming operations can be optimized using autonomous systems. The proposed project introduces a smart multipurpose agricultural robot designed to automate the fundamental farming processes of soil moisture detection, irrigation, seed sowing, and grass cutting in a synchronized and efficient manner. The robot is built around an Arduino Uno microcontroller, which serves as the central control unit. It receives real-time data from a soil moisture sensor and accordingly activates a relay-controlled water pump to irrigate dry soil. A seeder mechanism driven by an SG90 servo motor ensures uniform seed placement, while a DC grass-cutting motor operates continuously during the robot's forward movement. The motion of the robot is handled by 100 RPM DC gear motors controlled through an L298N motor driver module, allowing smooth and directional control.

Literature Review

Designing and Implementing a Versatile Agricultural Robot: A Vehicle Manipulator System for Efficient Multitasking in Farming Operations (2023) — Kumar S., Mohan S., Skitova V. This paper discusses a vehicle-manipulator system for multitasking in agriculture

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A. Verma, N. Gupta, and M. Patel, "IoT- Based Smart Agriculture for Real-Time Monitoring of Soil Moisture and Irrigation Control," *IEEE Internet of Things Journal*, vol. 8, no. 5, pp. 3685–3696, 2021. Discuss working of real time monitoring of soil moisture so we can process accordingly.

Methodology

The proposed system operates on a sequential control process managed by the Arduino Uno microcontroller, which coordinates all sensing and actuation tasks required for autonomous agricultural operation. Initially, the robot begins its movement using two 100 RPM DC gear

motors that are driven through an L298N motor driver module. The Arduino regulates both the direction and the speed of the motors using PWM signals, allowing the robot to move forward smoothly for approximately one meter across the field. Once the defined distance is covered, the robot halts, and the moisture sensor arm servo motor gradually lowers the soil moisture sensor into the soil. The sensor measures the soil's moisture content and sends an analog signal to the Arduino's input pin (A0). Based on this reading, the Arduino evaluates the condition of the soil. If the soil is found to be dry, the controller activates the relay module connected to the mini-DC water pump, turning it on for three seconds to supply sufficient water to the soil. If the soil is already wet, the pump remains inactive to conserve water and energy. After the irrigation phase, the seeder servo motor is triggered to rotate and release one seed into the soil. This ensures that seeds are sown at uniform intervals with minimal wastage. Simultaneously, a DC toy motor fitted with a cutting blade runs continuously throughout the operation, performing the grass-cutting function as the robot moves. Once all tasks in the sequence— movement, soil testing, irrigation, seeding, and grass cutting—are completed, the system automatically resets and repeats the entire process. This automation cycle continues until the operation is stopped manually. The methodology thus integrates multiple agricultural functions within a single compact robotic system, enhancing precision, efficiency, and productivity while minimizing the need for manual labour.

Block diagram

The block diagram of the proposed Smart Multipurpose Agricultural Robot represents the interconnection of various hardware components that enable autonomous farming operations such as soil moisture detection, irrigation, seeding, and grass cutting. At the core of the system is the Arduino Uno microcontroller, which serves as the main control unit. It receives input signals from the soil moisture sensor connected to its analog input pin (A0). The Arduino processes this data to determine whether the soil is dry or wet. When the soil is detected as dry, the Arduino sends a HIGH signal to the relay module, which in turn activates the mini-DC water pump for irrigation. The pump runs for approximately three seconds to supply adequate water, after which it automatically turns off.

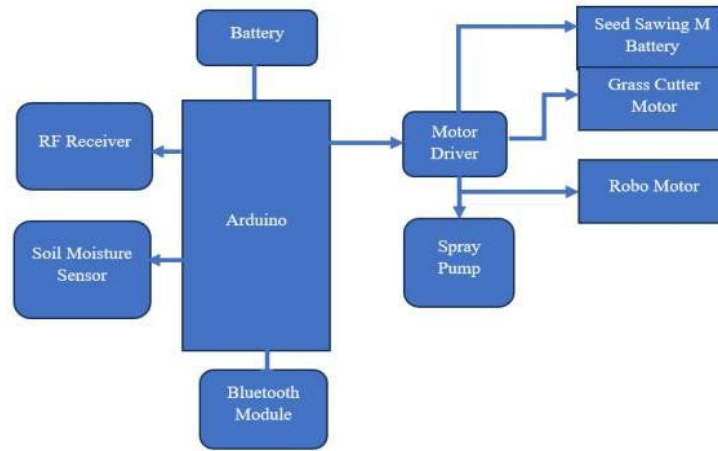


Fig.1. Block Diagram

The moisture sensor is mounted on a servo motor (SG90), which lowers it into the soil during measurement and raises it back afterward. Another SG90 servo motor is used for the seeding mechanism, which releases one seed after each moisture reading cycle. For locomotion, two 100 RPM DC gear motors are connected through an L298N motor driver, allowing forward movement and directional control. The DC toy motor attached to the chassis operates a grass-cutting blade, running continuously during the robot's movement. The entire system is powered by a 3.7V Li-ion battery pack with a common ground connection to ensure stable operation. All components—including the motors, sensors, servos, and relay—are interfaced with the Arduino, which coordinates their actions through programmed logic. This configuration allows the robot to move autonomously for about one meter, stop, check the soil condition, water, if necessary, drop a seed, and then continue its operation cyclically—thereby automating essential agricultural tasks efficiently and precisely.

Arduino uno:

It comes with 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header for programming the microcontroller with an external programmer. The digital pins on the Arduino Uno can function as either inputs or outputs, allowing you to control various electronic components such as LEDs and motors. Meanwhile, the analog inputs enable you to read values from sensors, including temperature and light sensors. To program the board, you can use the Arduino programming language, which is based on C++. The software for the Arduino, which is free to download, includes a user-friendly integrated development environment (IDE) that simplifies the process of writing and uploading code to the board.



Fig.1 Arduino Uno

100 RPM gear motor:



Fig.2 gear motor

A 100 RPM gear motor is a DC motor with a gearbox that reduces speed to ~100 revolutions per minute while increasing torque. It typically operates at 6–24V DC and provides medium torque for small machines or robots. These motors are used in robotics, seeders, conveyors,

and other low-speed, high-torque applications. The shaft size is usually 6–8 mm, and metal or plastic gears determine durability. Actual speed drops under load, and reversing polarity changes rotation direction. Infrared sensor The IR sensor, also known as an infrared sensor, is a type of electronic part that emits or detects IR radiation to identify certain features in its environment. The visionary senses used by humans to identify barriers are similar to this type of sensor. The two components of an infrared sensor, the emitter and the receiver (transmitter and receiver), are collectively referred to as an optocoupler or a photo-coupler. In this case, an IR LED is employed as an emitter and an IR photodiode as a receiver.

SG90:



Fig.3 SG90

The SG90 is a micro servo motor widely used in hobby electronics and robotics. It operates on 4.8–6V DC and can rotate approximately 180° (0–180 degrees). It provides small torque, usually around 1.8–2.2 kg·cm, making it suitable for lightweight projects like robotic arms, camera pans, and small RC vehicles. The SG90 has three wires: power (red), ground (brown or black), and signal (orange or yellow) for PWM control. It's lightweight, compact, and easy to interface with Arduino or other Microcontrollers.

Results and discussions

The multi-function agricultural robot integrates soil moisture sensing, automatic irrigation, seeding, and grass cutting into a single compact system controlled by an Arduino Uno. Using 100 RPM DC gear motors for locomotion, SG90 servo motors for sensor and seed deployment, and a relay- controlled mini water pump, the robot performs tasks autonomously in a cyclic manner.



Fig. Result 1



Fig. Result 2

Testing demonstrated accurate soil moisture detection, efficient water usage, uniform seed placement, and continuous grass cutting during movement. The system reduces manual labor, improves precision, and optimizes energy consumption, highlighting the potential of automation in small-scale farming. Overall, the project showcases a cost-effective and practical approach to smart agriculture.

Conclusions

The proposed multi-function agricultural robot successfully demonstrates the integration of sensing, actuation, and control to automate essential farming operations such as soil moisture monitoring, irrigation, seeding, and grass cutting. By combining 100 RPM DC gear motors, SG90 servo motors, a relay-controlled pump, and an Arduino Uno controller, the system operates efficiently and reduces the need for manual labor. Its modular and compact design ensures adaptability to small-scale farming, cost-effectiveness, and ease of maintenance.

The cyclic operation enhances precision and productivity, while simulation and modeling provide insights for optimization. Overall, this project highlights the potential of robotics and automation in promoting smart, sustainable, and efficient agricultural practices.

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