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Automatic Multipurpose Agricultural Robot

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Abstract
The agricultural industry is undergoing a transformation to address the growing demands of population and climate change. Traditional manual methods are being replaced by automated solutions to improve efficiency and reduce labor. This project presents a multipurpose agricultural robot that can be controlled via a smartphone, allowing farmers to perform tasks such as plowing, seed sowing, water spraying, and monitoring temperature and humidity. By integrating wireless-communication technologies like Bluetooth or Wi-Fi, the system enables remote operation and data collection from the field. The robot uses microcontrollers and sensors to respond to commands from the mobile app, streamlining operations and enhancing productivity. Designed for small to medium farms, the system is both affordable and user-friendly. It supports sustainable agriculture by using resources efficiently, such as targeted water and pesticide application, and can be powered by solar or battery sources for eco-friendliness. Real-time sensing of soil moisture, temperature, and obstacles enhances decision-making. The robot's smartphone interface ensures ease of use even for farmers with minimal technical skills. Its modular design allows customization based on different crops and farm sizes. By consolidating multiple functions into one platform, it reduces the need for various machines, cutting costs. Additionally, it protects users from direct exposure to chemicals during spraying operations. This smart system promotes digital literacy among farmers and lays the groundwork for future integration of AI and cloud-based monitoring.

Keywords: Smartphone, Communication, Sustainable, Sensing, Farm, Integration

Introduction

Agriculture plays a crucial role in ensuring food supply and economic stability, particularly in rural-based economies. However, modern farming faces significant challenges such as labor shortages, rising costs, and inefficient traditional practices. In this project these robots can perform multiple tasks like plowing, sowing, watering, and spraying pesticides through a compact, automated system. Controlled via a mobile application, they enable farmers to operate the robot remotely with ease, requiring minimal technical expertise. The system is equipped with sensors, microcontrollers, and wireless modules that help collect field data and carry out precise operations. It is powered by batteries or solar energy, making it suitable for off-grid and environmentally conscious farming. The robot improves resource management by

reducing wastage and increasing the accuracy of input applications. Its smartphone interface makes it accessible to small-scale farmers, even in remote areas with limited infrastructure. Overall, this smart farming solution supports productivity, sustainability, and digital empowerment in agriculture.

Existing system

To avoid all circumstances that are arising while undergoing agriculture practices, a multipurpose agricultural robot is designed as a solution. This robot can be operated by labours and farmers by manually controlling the robot activities. Moreover, the agricultural robot is built in such a way to perform only ploughing and sowing operations only by reducing the human effort, but not improvising the time management, skill- based activities and also water management techniques. Later, a multipurpose agricultural robot is designed and developed as a highly efficient machine that is operated manually for performing operations like ploughing, sowing, watering and irrigation practices by improvising some entities. Also, this system is not automated and not improvised respective to present technology development that involves energy management, low cost with high output efficiency and other techniques involving all scale farm-land compactness.

Proposed methodology

The proposed system tends to design and develop an automated and compactable multipurpose agricultural robot that is capable of operating all type of scale range lands by performing farming activities including soil temperature and humidity test operations. The proposed system is developed through using embedded system technology, micro-controller, sensors, motors, software code and other entities by interfacing all together. The robot is capable of ploughing, sowing, irrigation, pesticide application, watering and measuring environmental parameters by operating based on the information provided via wireless communication and user interface application. A dedicated mobile application is developed to ensure precise control of the automated robot. It does inspire youngsters into agriculture practices on considering its efficiency and mode of agricultural activity operations. It also ensures economic profit to the farmers.

Table 1: List of components used

Name of the component	Specification	Quantity
Micro - controller	ESP 32	1
Motor driver	L298N	4
Motor	DC	4
Moisture sensor	Capacitive	1
Servo motor	SG90	1
Buck converter	12V to 5V	2
Battery	12V, 4.5A	1
Temperature sensor	DHT 11	1
Relay	5V, 1 C/O	1
Water pump	3V – 6V Submersible	1

Figure 1: Block diagram

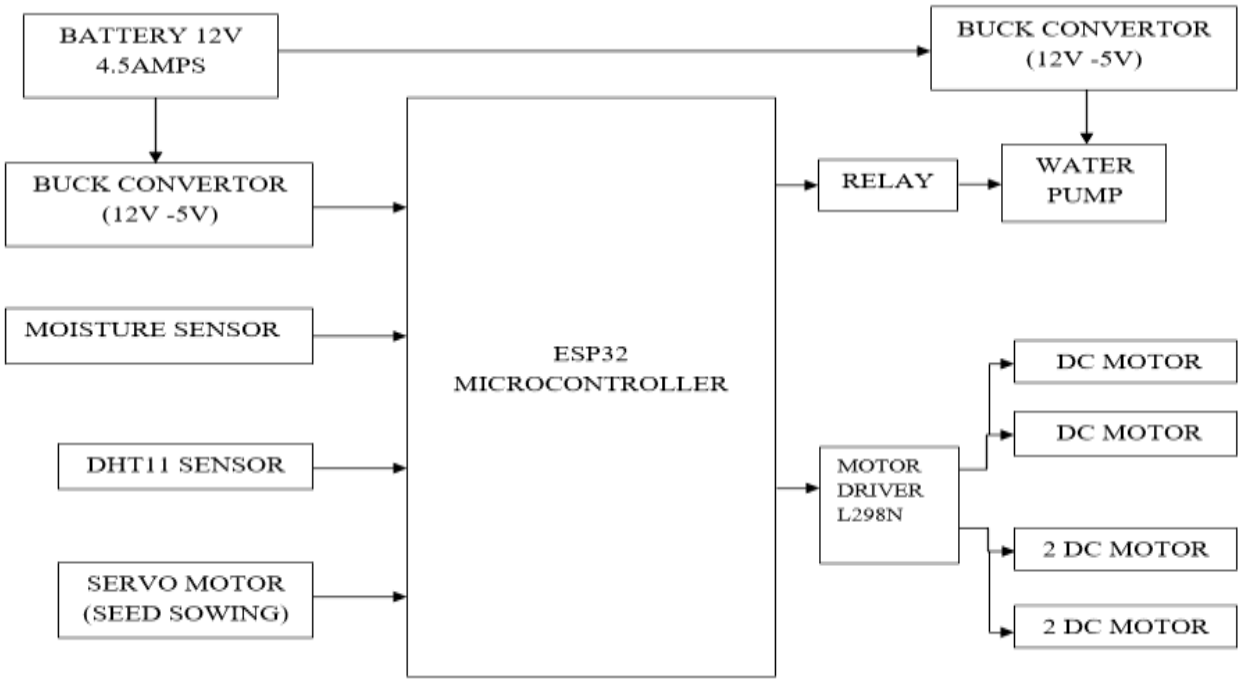
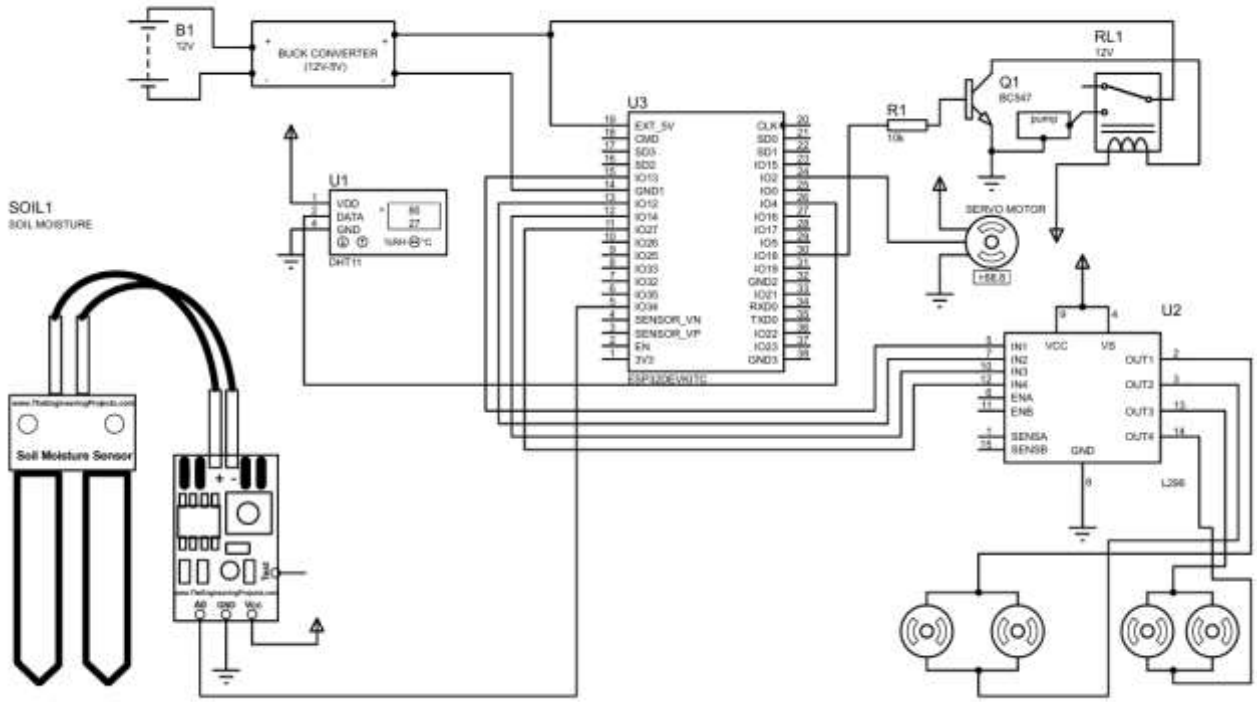


Figure 2: Circuit diagram



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