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Smart farming using IOT based Agri BOT

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Abstract: A multifunctional agricultural robot using IOT is a system that can perform various agricultural tasks, such as seed sowing, weed cutting, fertilizer dispensing, moisture sensing, pesticide spraying, and water spraying. The robot is controlled using IOT technology, which allows it to be monitored and operated remotely. The robot consists of a mobile platform, various sensors, actuators, and an IOT controller. The mobile platform allows the robot to move around the farm field. The sensors are used to collect data about the environment, such as soil moisture and weed growth. The actuators are used to perform various agricultural tasks. The IOT controller is responsible for processing the sensor data and controlling the actuators. The robot can be controlled using a variety of devices, such as a smartphone, tablet, or laptop. The user can use the device to select the task that the robot should perform and to monitor the robot's progress. The use of IOT technology in agriculture has several benefits. It can help to improve the efficiency and productivity of agricultural operations. It can also help to reduce the need for manual labor, which can be expensive and difficult to find. Additionally, IOT technology can help to improve the quality of agricultural products by providing farmers with more precise control over their operations.

Keywords: seed sowing, weed cutting, fertilizer dispenser, moisture sensor, pesticide spray, water spray

1. Introduction

Agriculture is a labour-intensive and time-consuming industry, and farmers are increasingly facing challenges such as climate change, water scarcity, and labour shortages. Multifunctional agriculture robots using IOT (Internet of Things) can help to address these challenges by automating a wide range of tasks, such as seed sowing, weed cutting, fertilizer dispensing, moisture sensing, pesticide spraying, and water spraying.
IOT-enabled agriculture robots use sensors to collect data about the environment and the crops, such as soil moisture levels, nutrient levels, and pest infestations. This data can then be used to control the robot's actions, such as when to sow seeds, apply fertilizer, or spray pesticides.

Multifunctional agriculture robots can offer several benefits to farmers, including:
- Increased efficiency and productivity: By automating repetitive and time-consuming tasks, robots can help farmers to save time and labour costs.
- Improved crop yields: Robots can help to ensure that crops are planted, fertilized, and irrigated at the optimal times and in the correct amounts. This can lead to improved crop yields and quality.

Here are some specific examples of tasks that a multifunctional agriculture robot using IOT could perform:
- Seed sowing: The robot could use sensors to identify the optimal locations for planting seeds, and then use a mechanical arm to plant the seeds at the correct depth and spacing.
- Weed cutting: The robot could use cameras and other sensors to identify weeds, and then use a mechanical arm or blade to cut them down.
- Fertilizer dispensing: The robot could use sensors to determine the nutrient levels in the soil, and then dispense fertilizer in the correct amounts to ensure that the crops are getting the nutrients they need.
- Moisture sensing: The robot could use sensors to monitor the moisture levels in the soil, and then trigger irrigation when necessary.
- Pesticide spraying: The robot could use sensors to identify pests, and then spray pesticides in the correct amounts to control the pests without harming the crops.

- Water spraying: The robot could use sensors to determine the water needs of the crops, and then irrigate the crops in the correct amounts to ensure that they are getting the water they need.
- A robot that can help to detect and diagnose plant diseases early on, so that farmers can take corrective action before the disease spreads.
- Multifunctional agriculture robots using IOT have the potential to make farming more sustainable and efficient, and to help farmers produce more food with fewer resources.

1.1 Problem Statement

The agricultural sector is facing a few challenges, including labor shortages, increasing input costs, and climate change. These challenges are putting pressure on farmers to find ways to improve the efficiency and sustainability of their operations. One way to address these challenges is to use robotics. Robots can automate tasks that are currently done manually, such as seed sowing, weed cutting, fertilizer dispensing, pesticide spraying, water spray, and moisture level measurement. This can save farmers time and labor, improve accuracy, and reduce costs.

1.2 Objectives

- Reduce labour costs and improve efficiency: Multifunctional agriculture robots can automate many tasks that are currently done manually, such as seed sowing, weed cutting, fertilizer dispensing, and pesticide spraying. This can help to reduce labour costs and improve the efficiency of agricultural operations.
- Improve crop yields and quality: By automating tasks such as irrigation and fertilization, multifunctional agriculture robots can help to ensure that crops receive the right amount of water and nutrients at the right time. This can lead to improved crop yields and quality.
- Reduce environmental impact: Multifunctional agriculture robots can help to reduce the environmental impact of agriculture by reducing the use of pesticides and herbicides, and by improving water and fertilizer efficiency.

1.3 Scope

- Increased productivity: The robot can automate a variety of tasks, which can free up farmers to focus on other aspects of their business.
- Reduced costs: The robot can help to reduce labour costs and can also help to improve the efficiency of resource use, such as water and fertilizer.
- Improved crop quality: The robot can help to improve crop quality by monitoring and controlling the environment in which the crops are grown.
- Reduced environmental impact: The robot can help to reduce the environmental impact of agriculture by using resources more efficiently and by reducing the use of pesticides and herbicides.

2. Literature Survey

The authors propose a multipurpose agricultural robot that can be used for seed sowing, grass cutting, pesticide spraying, fruit plucking, soil nutrition level detection, and irrigation. The robot is powered by solar energy and can be controlled through a web page. The robot uses a variety of sensors, including a colour camera, distance sensors, and a soil nutrient sensor, to perform its tasks. The robot is designed to be user-friendly and can be used in any type of soil. The authors believe that their robot can help to improve the efficiency of agricultural operations and reduce the need for manual labour [1].

Digital farming is the use of modern technologies such as sensors, robotics, and data analysis to automate farm operations and improve productivity. This paper reviews some of the latest achievements in agricultural robotics, specifically those used for autonomous weed control, field scouting, and harvesting. It is not realistic to expect an entirely automated farming system in the future, but agricultural robots are becoming an increasingly important part of digital farming. Some of the challenges facing agricultural robotics include object identification, task planning algorithms, and the digitization and optimization of sensors. One of the trends in agricultural field robotics is towards building swarms of small-scale robots and drones that can collaborate to optimize farming inputs and reveal hidden information. For robotic harvesting, an autonomous framework with several simple axis manipulators can be faster and more efficient than the currently used expensive professional manipulators [2].

Agri-bots are robots that are used in agriculture. They can be used for a variety of tasks, such as harvesting, pesticide spraying, weed control, and watering plants. Agri-bots can be controlled using an Android application, which makes them easy to use for farmers. Agri-bots are more efficient than traditional farming methods

because they can perform tasks more quickly and accurately. They are also more environmentally friendly because they can reduce the use of pesticides and herbicides. One of the challenges facing Agri- bots is the need to develop systems that can gather multi-modal, multi-character data in real time in the field. This requires combining plant biology and crop science with robotic vision and computer engineering. Overall, Agri-bots have the potential to revolutionize the agricultural industry by making it more efficient and productive [3].
The paper proposes an IOT-based robot for crop monitoring. The robot is equipped with a camera, sensors, and a gripper arrangement. It can be used to monitor the crop and the environment around the crop, and to identify and address plant diseases and insects. The robot can be used from the plantation period to the harvesting period. It can detect the plant type and calculate the area of the field itself. It monitors the soil health based on moisture level and PH level. It also monitors the plant health based on leaf colour. If the robot finds any problem with the field, it prompts the farmer in the local language. The Arduino IDE is used to write the code for the Arduino board, and Python is used to program the Raspberry Pi board. Overall, the proposed IOT-based robot for crop monitoring has the potential to be a valuable tool for Indian farmers. It can help them to improve crop yields and reduce losses due to plant diseases and insects [4].

3. Methodology

3.1. Block Diagram:

IOT Module: The IOT module allows the robot to communicate with other devices and systems. This allows the robot to be controlled remotely and to share data with other systems, such as a farm management system.
Power Supply: The robot is powered by a battery.
How the Robot Works:
The micro controller uses the data from the sensors to control the actuators. For example, if the moisture sensor detects that the soil is dry, the micro controller will turn on the water sprayer. If the weed sensor detects the presence of weeds, the micro controller will turn on the weed cutter.
For example, a farmer could use a smartphone app to control the robot's movement or to view the data collected by the sensors.

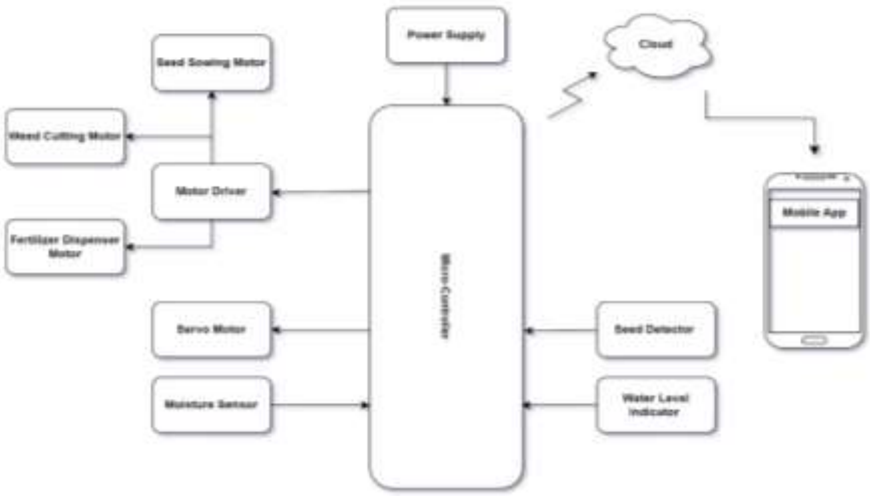

Fig. 1 - Block Diagram [12]

3.2. Environmental Monitoring System Based on UDP Communication

- An Environmental Monitoring System (EMS) based on UDP Communication multifunctional agriculture robot using IOT can be used to perform tasks like seed sowing, weed cutting, fertilizer dispenser, moisture sensor, pesticide spray, and water spray.
- The EMS would consist of a network of sensors that are deployed throughout the agricultural field. These sensors would collect data on various environmental conditions, such as temperature, humidity, soil moisture, and light levels. The data collected by the sensors would be transmitted to the multifunctional agriculture robot using UDP communication.
- The multifunctional agriculture robot would be equipped with a variety of actuators that would allow it to perform various tasks. For example, the robot could be equipped with a seed Sower, a weed cutter, a fertilizer dispenser, a moisture sensor, a pesticide sprayer, and a water sprayer.

3.3. Server Selection

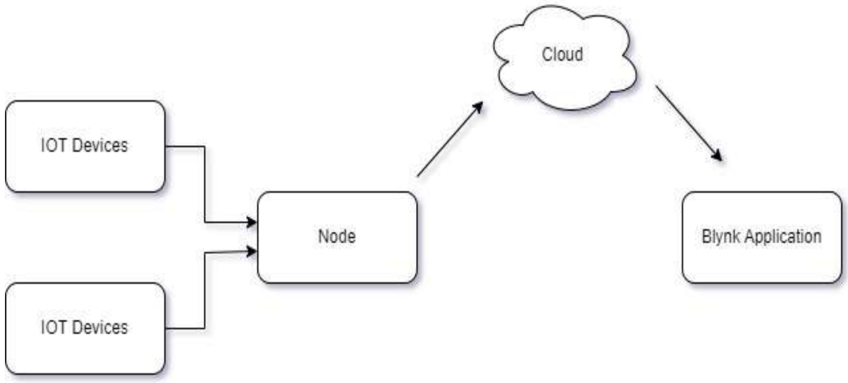

Fig. 2 - Blynk Server Operation

Server Selection:
Blynk server selection in an IOT project is an important decision that can affect the cost, features, security, and ease of use of your system. Here is a more detailed discussion of the factors to consider when choosing between the Blynk Cloud and a private Blynk server:

Cost- The Blynk Cloud has a free tier for up to 10 devices. If you have more than 10 devices, or you need to use premium features, such as the web dashboard or custom widgets, you will need to pay a subscription fee. The cost of a Blynk Cloud subscription depends on the number of devices and the features you need.

Features-The Blynk Cloud and private Blynk servers have the same core features, such as the ability to connect your hardware to the cloud, control your devices from a mobile app, and monitor sensor data. However, the Blynk Cloud also offers some additional features, such as:

- A mobile app for iOS and Android
- A web dashboard
- A community of users and developers
- Integrations with other IOT platforms

3.4. Development

3.5.5. Results

Autonomous seed sowing:

- The ESP32 reads the soil moisture sensor data.
- If moisture is within the desired range, the seed dispenser motor activates and dispenses a seed using a controlled mechanism.
- The seed detector confirms seed placement.
- The servo motor positions the robot for the next sowing location.

Weed removal:

- The robot navigates using the servo motor.
- The weed detector identifies weeds (ultrasonic for height, optical for color).
- Upon detection, the weed cutting motor activates to remove the weed.

Automated irrigation:
- The soil moisture sensor data is continuously monitored.
- When the soil gets dry, the ESP32 activates the water pump (connected externally) through a relay or motor driver.
- The water level indicator ensures the water reservoir is filled and pump operation stops when full.

Data monitoring and control (optional):
- The ESP32 can connect to the internet via Wi-Fi and send sensor data (moisture, temperature, etc.) to a cloud platform.
- A mobile app or web interface can be created to visualize this data and remotely control the robot's functions (activate irrigation, stop weed removal, etc.).

4. Conclusion

This IoT-based agriculture robot equipped with an ESP32 microcontroller, servo motors, and a comprehensive sensor suite offers a potent solution for automating agricultural tasks and enhancing precision farming practices. The robot's capabilities, including automated seeding, intelligent irrigation, targeted weed management, and optimization of fertilizer application, contribute to improved resource efficiency, increased crop yield, and reduced labor demands. The real-time monitoring and control capabilities empower farmers to make informed decisions based on valuable data, leading to a more sustainable and profitable agricultural operation.

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