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SMART AGRICULTURAL ROVER

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ABSTRACT

Agriculture is rapidly evolving with the integration of advanced technologies to address the increasing global demand for food. This paper discusses the development of an IoT based Agricultural rover designed to enhance smart farming practices. Utilizing Arduino, ESP8266, sensors, and actuators, the robot automates tasks like soil monitoring, irrigation, and mobility control. By leveraging cloud platforms for remote monitoring and control, this model advances precision agriculture, enhancing efficiency and sustainability

Keywords: IoT, Smart Farming, Agricultural rover, Automation, Precision Agriculture.

I. INTRODUCTION

The agricultural industry of today is fraught with labor shortages, resource inefficiencies, and variability in climate. With the aid of Internet of Things (IoT) and robotics, smart farming provides the solutions in the form of automation of tasks; notably with soil analysis, irrigation management and crop monitoring. With this motivation, this work presents an IoT-based Agricultural rover that provides real-time environmental data and automates essential tasks in precision agriculture.

II. METHODOLOGY

1. Hardware Implementation:

Microcontrollers:

- Arduino Uno: Acts as the main controller to process sensor data and manage actuator operations.
- ESP8266: Provides Wi-Fi connectivity to enable cloud communication.

Sensors:

- DHT11: Measures ambient temperature and humidity.
- Soil Moisture Sensor: Detects soil moisture levels to assist in irrigation decisions.
- Rain Sensor: Identifies rainfall to adjust irrigation schedules.

Actuators:

- L298 Motor Driver: Controls the movement of the robot's wheels.
- Servo Motors: Operate mechanisms for seed sowing and water dispensing.
- Water Pump: Enables automated irrigation based on soil moisture data.

Connectivity:

- HC-05 Bluetooth Module: Allows for local communication and manual control when necessary.
- Wi-Fi Module: Connects the robot to a cloud platform for remote monitoring and control.

2. Software Implementation:

The control system of rover is made in Arduino programming in C/C++. The ESP8266 module handles the cloud interaction, sending sensor data to a cloud database. The ESP8266 module is assigned an IP address that allows users to check it without them even knowing, connecting directly to the webserver to check real field conditions. It is implemented on various IoT protocols like MQTT to transmit the sensed data and monitor it remotely.

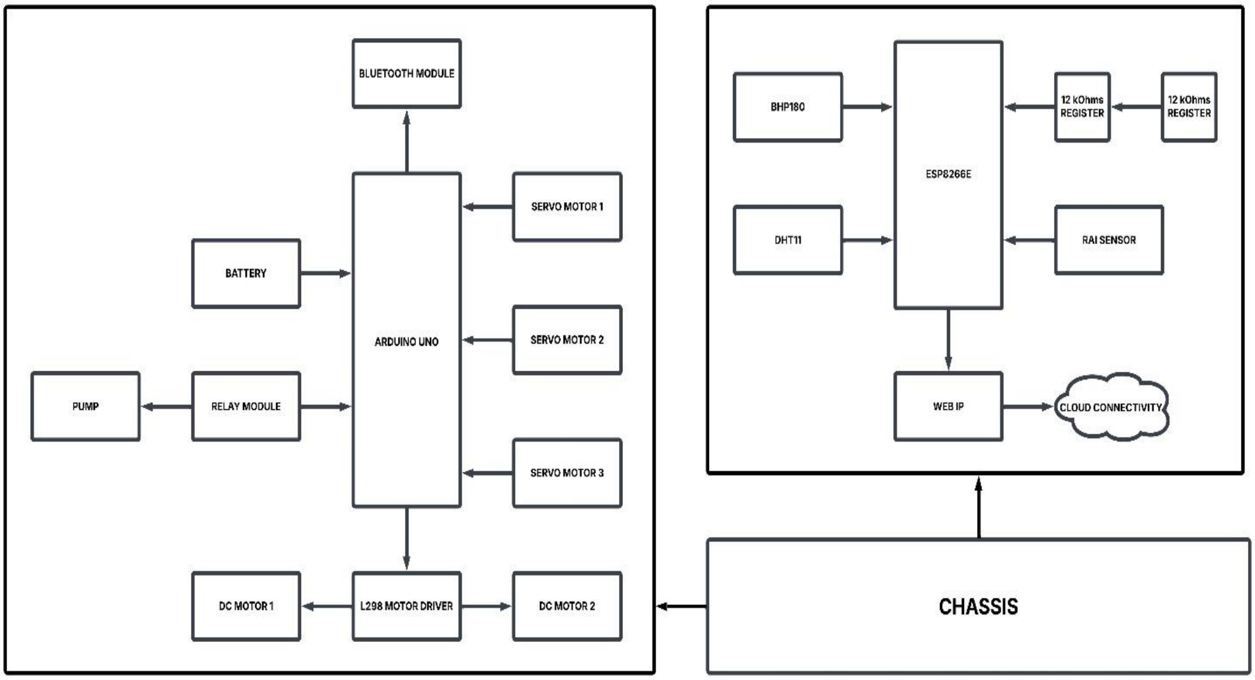

Figure 1: Block Diagram of the Rover.

3. Process of Functioning:

- Data Collecting: Sensors receive information about temperature, humidity, and soil moisture continuously.
- Data Transfer: The collected data are sent to the destination, that is, the cloud, for further analysis and remote observation.
- Automation Control: Based on sensor information, actuators are triggered by performing actions such as:
  - Switch on the water pump for irrigation.
  - Trigger the seed sowing organization.
  - Control the robot's movement for field coverage.

III. RESULTS AND DISCUSSION

The Agricultural rover was tested in a controlled agricultural environment, yielding the following observations:

- Real-time Monitoring: Sensors effectively transmitted data on temperature, humidity, and soil moisture to the cloud platform, enabling continuous monitoring.
- Automated Irrigation: The system autonomously activated the water pump based on soil moisture readings, optimizing water usage and ensuring adequate soil hydration.
- Seed Sowing Mechanism: The servocontrolled seed dispenser operated with precision, facilitating uniform seed distribution and planting depth.
- Mobility and Navigation: The robot navigated the field effectively using the L298 motor driver and wheel system, demonstrating reliable mobility for various farming tasks.

These results indicate that the Agricultural rover enhances efficiency and reduces manual labor in farming operations, contributing to sustainable agricultural practices

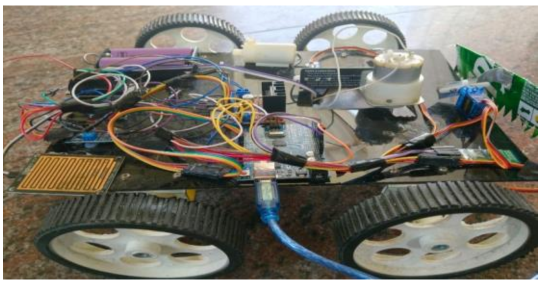

Figure 2: Final Output of Smart Agricultural Rover

IV. CONCLUSION

This paper outlines an implementation of an IoT enabled Agricultural rover for smart farming purposes, integrated with multiple sensors, cloud connectivity and automated farming functions. The system offers real time field data and automation of vital agricultural tasks resulting in better resource management and productivity. Some possible future enhancements could be to include AI for predictive analytics and GPS for better field coverage. There is also need to research on more sophisticated machine learning algorithms for irrigation and crop health monitoring as potential future directions.

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