



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Iot Based Seed Planting And Water Rover

¹ Digvijay Pandurang Patil, ² Sanket Sadhu Katare, ³ Rushikesh Ramesh Kale

⁴ Pabitra Kumar Guchhait

¹ Student, ² Student, ³ Student, ⁴ Assistant Professor

¹ Department of Electrical Engineering,

¹ G H Raison College of Engineering and Management, Pune, India

Abstract: The advancement of the Internet of Things (IoT) has opened new frontiers in modern agriculture, enabling automation and increased efficiency. This paper presents the design and implementation of an IoT-based seed planting and water rover, aimed at enhancing precision farming techniques. The system is built on a mobile robotic platform equipped with sensors and actuators to perform two primary functions: automated seed planting and controlled water dispensing. The rover operates autonomously or via remote access, guided by sensor feedback. Soil moisture sensors help determine the appropriate locations and timings for planting and irrigation. The seed dispenser mechanism ensures uniform spacing, while the water module delivers precise quantities of water to each planted seed, minimizing waste and promoting healthy crop growth. Real-time data is collected and transmitted to a cloud-based monitoring system, allowing farmers to observe field conditions and rover performance remotely. This integration of IoT not only reduces manual labor but also improves crop yield by optimizing essential agricultural operations. The project emphasizes sustainability, efficiency, and scalability, offering a smart solution for small to medium-scale farms and contributing to the digital transformation of agriculture.

Key words: - Smart Farming, Precision Agriculture, Autonomous Rover, Seed Planting Robot, Soil Moisture Monitoring

Introduction

In the age of smart agriculture, the integration of automation and IoT technologies is transforming traditional farming methods. A notable advancement in this field is the IoT-enabled Seed Planting and Watering Rover—a fully autonomous robotic system that streamlines the process of sowing seeds and watering them with minimal human effort. This rover utilizes components such as a DHT11 sensor, an Arduino Uno, and an HC-05 Bluetooth module to continuously monitor environmental factors like temperature and humidity. By analyse this real-time data, the system determines the most suitable conditions for planting seeds and providing irrigation.[1]

The rover operates using a combination of solar and battery power, promoting energy efficiency and enabling longer operation in the field. It features a seed dispenser and a servo-driven watering mechanism that deliver seeds and water at carefully controlled intervals. This design enhances precision, minimizes labour requirements, conserves water, and reduces seed loss. By automating key agricultural processes, the system presents a scalable and eco-friendly approach to tackle future farming challenges ranging from advanced precision agriculture on Earth to potential use in extraterrestrial farming. The fusion of IoT technology with agricultural robotics marks a significant advancement toward fully automated, intelligent farming solutions.[2]

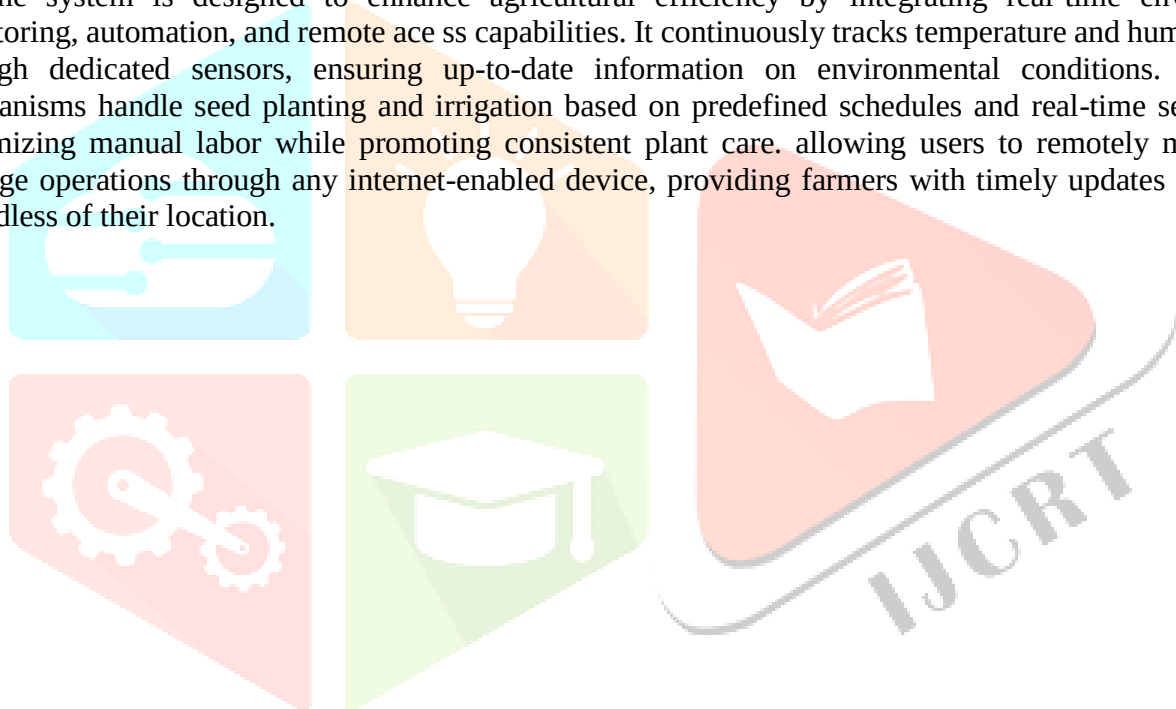
I. Literature Survey

Smart agriculture is reshaping traditional farming by integrating advanced technologies like automation, IoT, robotics, and wireless communication. These innovations aim to boost agricultural efficiency, reduce reliance on manual labor, and optimize the use of available resources. A significant development in this domain is the use of autonomous systems capable of performing tasks such as seed planting and irrigation. These systems typically incorporate microcontrollers and environmental sensors that monitor real-time conditions—like temperature and humidity—to make informed decisions about when to plant and water crops. Many are also connected to remote data platforms and powered by renewable energy sources, making them sustainable and well-suited for large-scale agricultural applications.[3]

Modern research and development in agriculture is increasingly focused on creating versatile robotic systems that can perform multiple functions such as tilling, seed sowing, and crop spraying. Designed to operate effectively across different types of terrain, these advanced agricultural robots are often equipped with wireless control systems that enable real-time monitoring and remote operation.[4]

II. Working Principle

The system is designed to enhance agricultural efficiency by integrating real-time environmental monitoring, automation, and remote access capabilities. It continuously tracks temperature and humidity levels through dedicated sensors, ensuring up-to-date information on environmental conditions. Automated mechanisms handle seed planting and irrigation based on predefined schedules and real-time sensor input, minimizing manual labor while promoting consistent plant care. allowing users to remotely monitor and manage operations through any internet-enabled device, providing farmers with timely updates and control regardless of their location.



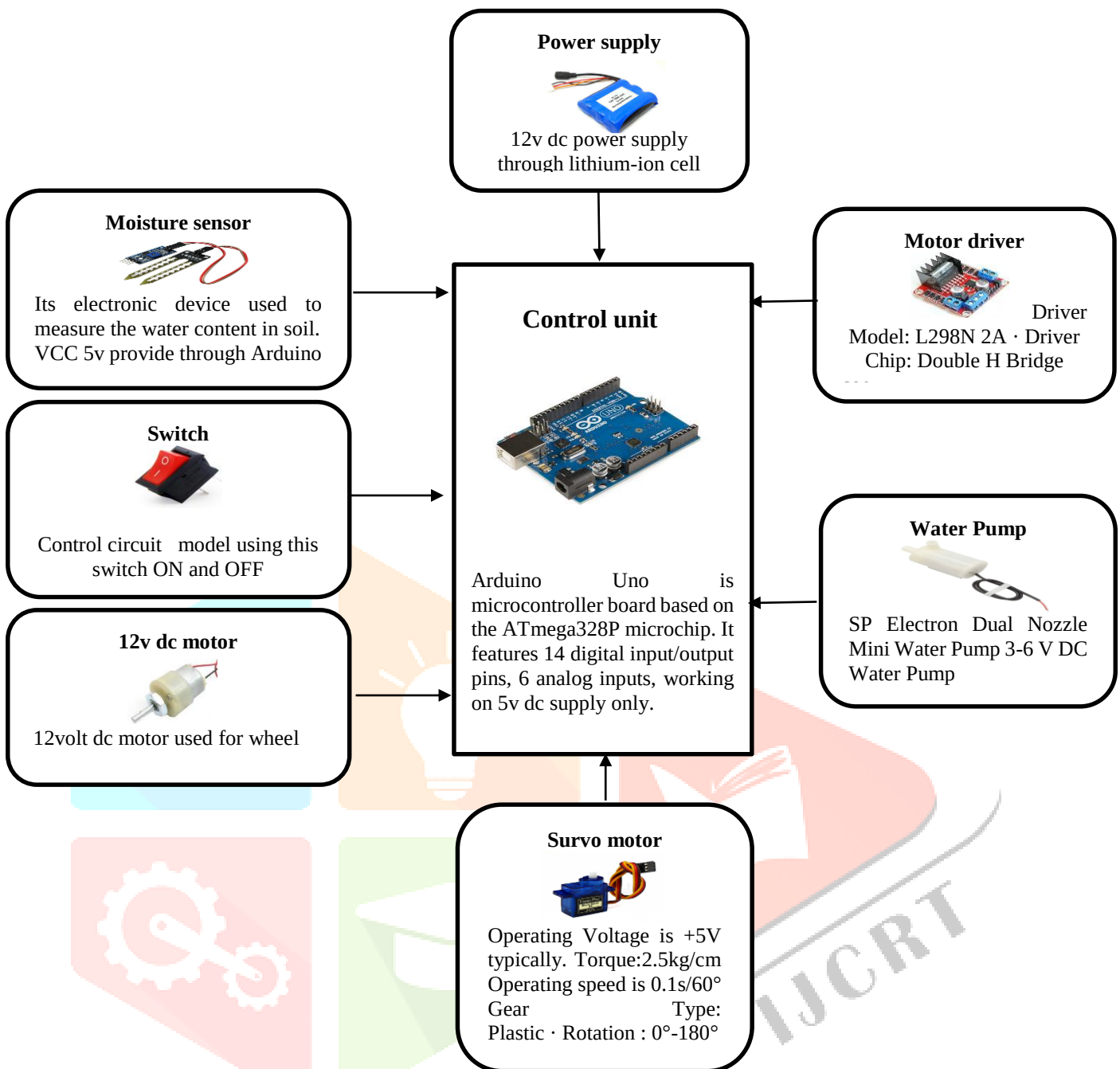


Fig .1 Block diagram of model

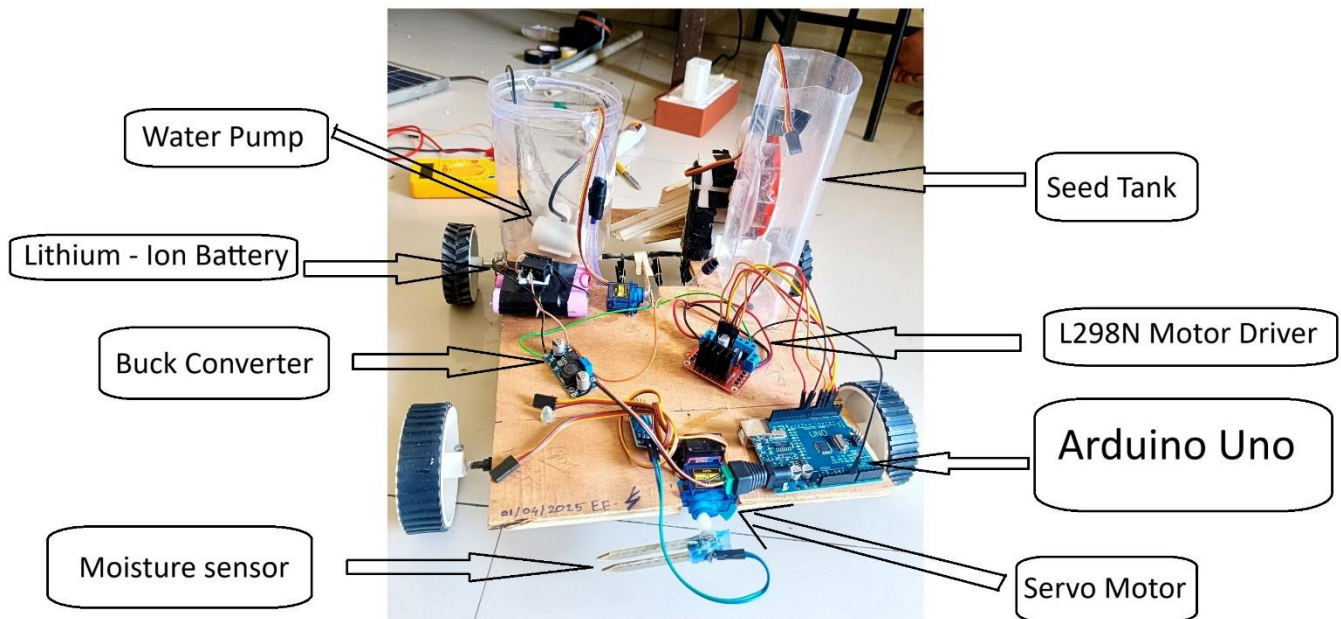
The diagram shows an automated control system, likely used for applications such as irrigation or mechanical automation. At the core of this system is a control unit, which manages inputs and directs outputs accordingly. The system is powered by a power supply that provides electricity to all the connected components, including the control unit, sensors, and motors.

Inputs to the control unit include signals from a moisture sensor, a manual switch, and a 12V DC motor. The moisture sensor detects the soil's moisture level, enabling the system to determine when irrigation is needed. The switch allows for manual operation or system control. The 12V DC motor could serve mechanical purposes, such as adjusting positions or driving a mechanical part.

On the output side, the control unit operates a servo motor, which may be used for accurate movements like aiming a sprinkler. It also sends signals to a motor driver, which then powers the water pump motor. The motor driver ensures the water pump receives the correct voltage and current, allowing the system to deliver water only when required, thus conserving resources and operating efficiently.

- HARDWARE COMPONENTS**

Fig. 2 vision of hardware



Microcontroller (Arduino UNO)

The Arduino Uno is a microcontroller board based on the ATmega328P. It operates at a voltage of 5V and typically requires an input voltage between 7–12V, though it can handle a range from 6–20V. The board runs at a clock speed of 16 MHz and features 14 digital input/output pins, 6 of which provide PWM output. It also includes 6 analog input pins.

Moisture Sensor

The Soil Moisture Sensor typically measures the water content in soil using electrical resistance. It operates on 3.3V to 5V and outputs either analog or digital signals. The analog output gives varying voltage based on moisture level.

DC Motors and Motor Driver

torque and low-speed rotation, 6V to 12V DC power supply, 200–300 mA.

The L298N motor driver operates on 5V logic and can drive two DC motors or one stepper motor. It supports motor supply voltages from 7V to 35V and can handle up to 2A per channel. It allows bidirectional control and PWM speed control via input pins. It includes built-in heatsink and an onboard 5V regulator

Water Pump

A typical mini water pump operates on 3V to 12V DC, with a recommended voltage of 6V or 9V. It has a flow rate of around 80–120 liters/hour and consumes 100–300 mA of current.

Lithium-ion Battery

A 12V lithium-ion battery typically has a nominal voltage of 11.1V (3 cells in series) and a fully charged voltage of 12.6V. Common capacities range from 1000mAh to 5000mAh or more. support up to 2A–5A continuous discharge.

Buck Converter

A buck converter is a DC-DC step-down voltage regulator. It typically accepts an input voltage from 12V into 5V.

Bluetooth Module (HC-05)

The HC-05 is a Bluetooth 2.0 + EDR module designed for wireless serial communication. It operates on the 2.4 GHz ISM band, supports UART communication with baud rates from 9600 to 115200 bps, and offers a range of approximately 10 meters

- **WORKING FLOWCHART**

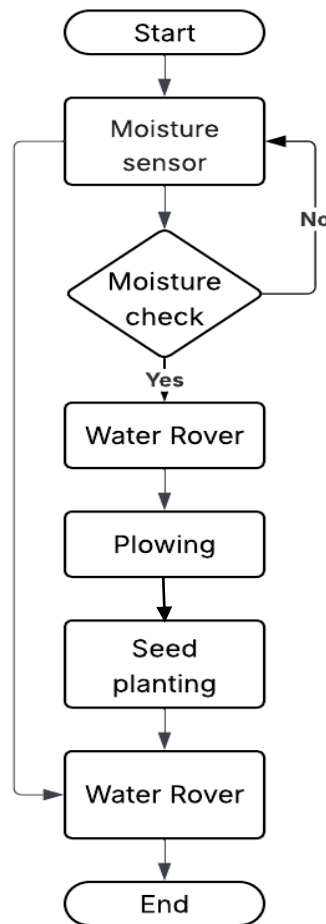
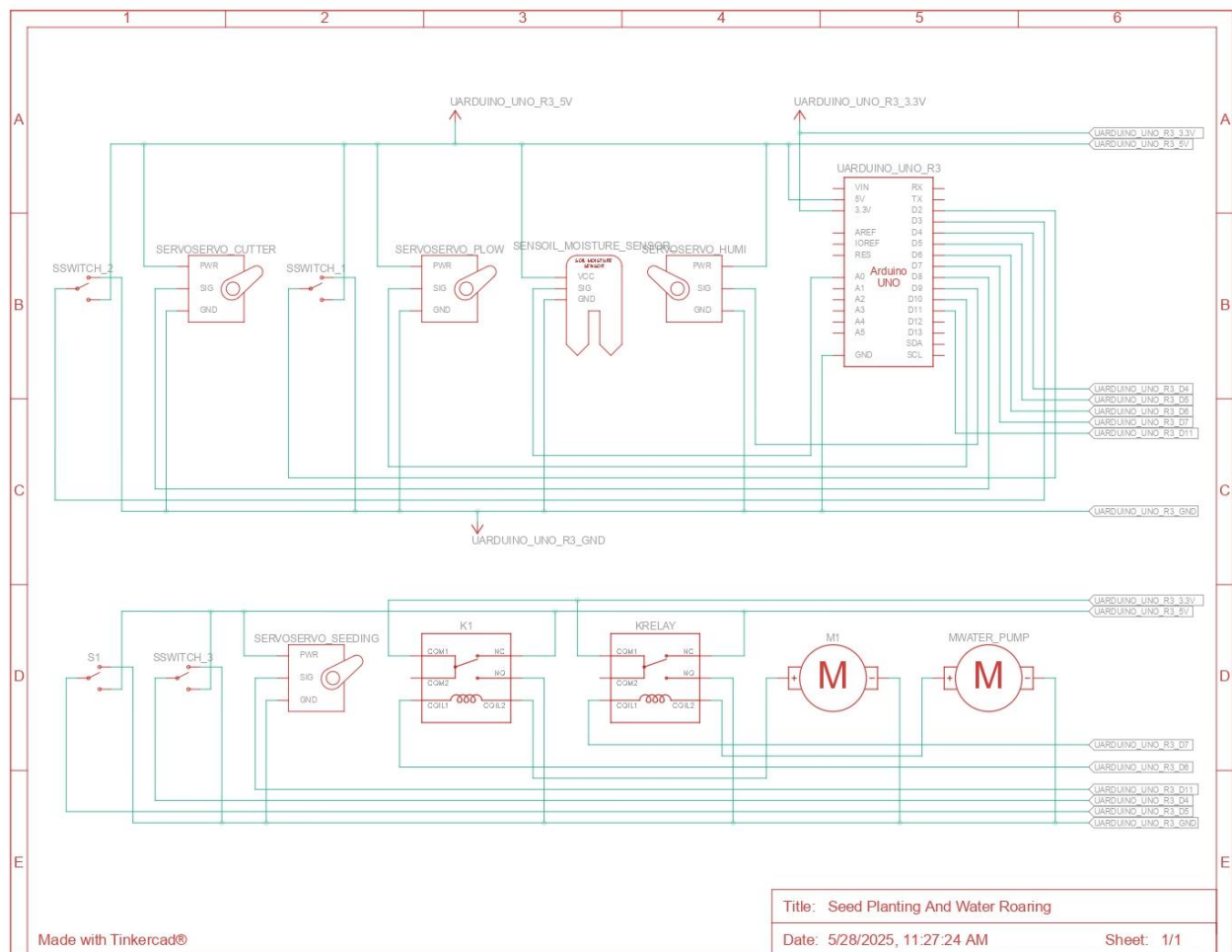


Fig.3 flow chart of working model.

This flowchart represents an automated farming sequence. It begins by using a moisture sensor to check the soil. If the moisture level is sufficient, the system activates a water rover, performs plowing, carries out seed planting, and then uses the water rover again before completing the process. If the moisture is inadequate, it keeps checking until suitable conditions are met.

• CIRCUIT DIAGRAM OF MODEL



III. RESULTS AND DISCUSSION



The implementation of the IoT-based seed planting and watering rover has significantly improved agricultural operations by introducing automation into two of the most critical farming activities: seed distribution and crop irrigation. Through the precise control of seed placement, the system ensures even distribution across the field, leading to better crop density and healthier plant growth. This method eliminates human errors commonly seen with manual planting, such as uneven spacing, which can affect crop yields.

Additionally, the system is equipped with a variety of sensors that enable real-time monitoring of environmental factors, including soil moisture, temperature, and humidity. These sensors constantly collect and send data to an IoT platform like Thing Speak, where farmers can easily access and analyze the information from any internet-connected device. This real-time visibility allows farmers to make informed decisions regarding field conditions without having to be physically present, saving both time and effort.

Water management is another area where the system shows clear benefits. By continuously monitoring soil moisture levels, the rover automatically activates its water pump to irrigate the crops whenever necessary, ensuring that plants receive the right amount of water at the right time. This targeted watering approach helps prevent over-irrigation and water wastage, promoting efficient use of available water resources — an important factor in regions facing water scarcity.



Energy efficiency is another key feature of this rover system. It primarily operates using renewable solar energy, which not only reduces operational costs but also promotes eco-friendly farming practices. In situations where sunlight is insufficient, the system is designed to seamlessly switch to battery power, ensuring continuous operation without interruptions. This dual-power setup minimizes reliance on traditional electricity sources, making it ideal for remote or off-grid farming areas.

Overall, the results achieved from deploying the IoT-based seed planting and watering rover demonstrate a significant enhancement in farming efficiency, resource management, and sustainability. Farmers are now able to optimize crop planting, maintain ideal soil conditions, and monitor their fields remotely, leading to increased productivity and reduced labor costs. The use of smart, energy-efficient technologies not only supports sustainable farming practices but also makes modern agricultural solutions more accessible to farmers in both developed and developing regions.

- **Calculations**

1. **Quantity**

Time (in minute)	Distance (in meter)	Seed (in kg)	Water (in ltr)
1	6	2	1

2. **Speed**

Time (in minute)	Distance (in minute)	Wheel Speed(m/s)	Seeding Speed(rpm)	Water Pump Speed(rpm)
1	6	0.1	85	100

- **Calculations for 1 Acre**

Distance (m)	Wheel Speed(m/s)	Seeding Speed(rp m)	Water Pump Speed(rpm)	Module Dimension (L*B*H)	Plower Dimension (L*B*H)	Required Time (hr)
100 * 40.47 (4046 m ²)	0.1	85	100	0.3m * 0.3m * 0.3m	0.1m * 0.1m	107hr

IV. Conclusion

At its core, the rover integrates advanced sensors, microcontrollers, and wireless connectivity to monitor environmental conditions and execute operations with precision. The sensors are used to assess real-time soil conditions such as moisture levels. Based on the feedback from these sensors, the rover decides whether watering is needed, and if so, it activates the water pump to irrigate the soil. This targeted watering approach helps conserve water, a critical advantage in areas prone to drought or water shortages.

Seed planting is another key function managed by the rover. As it moves across the field, the rover systematically plants seeds at optimal intervals, ensuring even spacing and better growth conditions. This level of consistency is difficult to achieve through manual labor, especially over large farming areas. By automating the planting process, farmers can achieve higher yields and better crop uniformity with minimal physical effort.

In conclusion, the IoT-based seed planting and watering rover is a revolutionary tool in the field of agriculture. It combines technology with traditional farming needs, creating a system that is efficient, affordable, and environmentally friendly. By reducing human effort, saving critical resources, and boosting productivity, this innovation is helping farmers move toward a smarter, more sustainable future. It is particularly beneficial for farmers in rural or low-resource areas, offering them the opportunity to improve their yields, reduce costs, and adopt modern farming methods without significant financial burden.

V. ACKNOWLEDGMENT

The author extends heartfelt appreciation to everyone who contributed to the research and experimental processes involved in this work. Special thanks are also given to the institution for providing essential resources and computing support, which played a crucial role in the successful completion of this study.

VI. References

- [1] G Nagarjuna Reddy, G Maheedhar Reddy, G Balaji, CH Muni Harish. (2022, Jun) IOT Based Seed Planting and Watering Rover
- [2] Al-Mamun, G. S. U., Hossain, M. I., Hasan, M. R., Rahman, A., D'Costa, S. M., Islam, M. R., ... & Hoque, A. (2019, November). Performance analysis of multipurpose AGROBOT. In 2019 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE) (pp. 1-4). IEEE
- [3] Zanwar, Shrinivas R, Kokate R D. Advanced Agriculture system. IAES International Journal of Robotics and Automation. 1(2), (2012)107-112.
- [4] Liu, Hui, Norbert Stoll, Steffen Junginger, Kerstin Thurow. "A common wireless remote-control system for mobile robots in laboratory." In IEEE International Instrumentation and Measurement Technology Conference (I2MTC). (2012); pp. 688 693.

- [5] Mendez, Gerard Rudolph, Subhas Chandra Mukhopadhyay. "A Wi-Fi Based Smart Wireless Sensor Network for an Agricultural Environment". In Wireless Sensor Networks and Ecological Monitoring. (2013); 247-268.
- [6] Kulkarni V A, Ajit G Deshmukh. "Advanced Agriculture Robotic Weed Control System." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. 2 (10), (2013) 5073-5081.
- [7] Jian-sheng, Peng. "An Intelligent Robot System for Spraying Pesticides." The Open Electrical & Electronic Engineering Journal. 8, (2014), 435-444.
- [8] Shivaprasad B S, Ravishankara M N, Shoba B N. "Design and implementation of seeding and fertilizing agriculture robot." International journal of application or innovation engineering & management (IJAIEM), 3 (6), (2014). [11] Mahesh R, Pundkar A. "Seed sowing machine: A review." International journal of engineering and social science. 3 (3), (2014) 1-5.

