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Spider Agri-Bot: Integrated Grass Cutter and Pesticide Sprayer

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Abstract - *The "Spider Agri-Bot: Integrated Grass Cutter and Pesticide Sprayer" is an intelligent farming device that combines three key functions: spraying pesticides, cutting grass, and measuring the pH of water. Its spider-like design allows it to move easily across various types of terrain, including uneven fields. The robot ensures even pesticide distribution, protecting crops, while also cutting grass to maintain a clean field.*

Introducing the Pesticide Sprayer Spider Robot, an innovative solution aimed at revolutionizing agricultural and gardening practices. This multifunctional robot features a precise pesticide spraying system, enabling targeted application that reduces chemical usage while maximizing pest and disease control. Alongside this, it incorporates an advanced grass cutter designed to efficiently trim grass and weeds, promoting a well-maintained landscape. The robot also includes a sophisticated pH meter, which continuously monitors water quality, providing essential information on acidity and alkalinity to ensure optimal conditions for plant growth. Its spider-like agility allows it to navigate different terrains with ease, making it ideal for both large agricultural fields and smaller gardens. By integrating these vital functions, the Pesticide Sprayer Spider Robot enhances productivity and supports sustainable practices, helping users cultivate healthier and more vibrant environments.

Key Words*: *Spider Agri-Bot[1], Grass Cutter[2], Pesticide Sprayer[3], pH meter[4], Crop Protection[5], Terrain Navigation[6], Sustainable practices[7], Pest Control[8], Productivity Enhancement[9].

1. INTRODUCTION

The "Spider Agribot: Integrated Grass Cutter and Pesticide Sprayer" is an advanced farming device that performs three crucial tasks: spraying pesticides, cutting grass, and measuring the pH of water. With a spider-like design, it can effortlessly navigate various terrains, including uneven fields. The robot ensures even pesticide application to protect crops and also trims grass to maintain field cleanliness. Operated via remote control, it uses sensors to measure water pH and avoid obstacles, ensuring safe and efficient operation.

2. LITERATURE SURVEY

Title	Focus	Key Source	Publisher
Spider Robot Design (2010-2015)	Multi-legged spider robots for improved mobility on uneven agricultural fields.	” Legged Robots for Precision Agriculture," Robotics and Autonomous Systems, 2011.	Elsevier
Precision Spraying Systems (2015-2017)	Font Development of advanced pesticide spraying systems for accuracy and environmental safety.	"Precision Spraying Systems in Agriculture," Computers and Electronics in Agriculture, 2015.	Elsevier
Dual-Function Robot Integration (2017-2018)	Combining grass-cutting and pesticide spraying in one robot to improve farm efficiency.	"Dual-Function Robots for Field Maintenance," Agricultural Engineering International: CIGR Journal, 2017.	CIGR (International Commission of Agricultural and Bio systems Engineering)

Chart -1: Literature Survey

3. PROBLEM STATEMENT

Farmers are often exposed to harmful chemicals when manually spraying pesticides. Tasks like manual grass cutting and pesticide spraying are both time-consuming and labor-intensive. An imbalance in pH levels can lead to the sprayed mixture harming crops, resulting in burns or stunted growth. Traditional methods often lack efficiency, causing uneven pesticide distribution and inconsistent grass cutting.

Therefore, there is a growing need for an automated solution to minimize human involvement in these processes.

4. OBJECTIVE OF THE PROJECT

Develop a robot capable of both spraying pesticides and cutting grass, while also measuring the pH of water using a single machine. Ensure the robot applies the correct amount of pesticide and cuts grass evenly, optimizing time and resources.

Design the robot to navigate various terrains, including uneven or rough ground, with a spider-like structure for enhanced stability.

Incorporate built-in sensors to measure the pH of water sources, guaranteeing the best water quality for crops. Ensure the robot operates reliably and safely, with features to avoid obstacles and manage issues efficiently. Make the robot user-friendly, making it easy for users to operate and maintain.

5. HARDWARE REQUIREMENT

ATmega328 Controller, DC Motors, BLDC Motor, ph sensor, Pump Motor, Water Tank, Motor Drivers, Bluetooth Module HC-05.

Sr.no	Name of Component/Module	Specification
1	ATmega328p Microcontroller	- Operating Voltage: 1.8V to 5.5V - Clock Speed: 16 MHz - Flash Memory: 32 KB - RAM: 2 KB - EEPROM: 1 KB - GPIO Pins: 23
2	DC Motor (12V)	- Voltage: 12V - Current: 0.5A to 2A - Speed (RPM): 3000 to 6000 RPM - Torque: 0.1 to 2 Nm - Power: 10W to 40W
3	BLDC Motor (A2212/10T 1400KV)	- Voltage: 12V - Current: 1.5A to 2A (under load) - Speed (RPM): 1400KV * 12V = 16,800 RPM (no load) - Torque: ~0.1 to 0.2 Nm - Power: 100W - Efficiency: ~80-85%
4	pH Sensor	- Range: 0 to 14 pH - Accuracy: ±0.1 pH - Operating Voltage: 3.3V to 5V - Output: Analog Voltage or I2C (depending on model) - Temperature: 0°C to 50°C
5	Pump Motor (12V)	- Voltage: 12V - Current: 0.5A to 2A - Flow Rate: 100 to 500 L/h - Max Head (Lift): 2 to 4 meters - Power: 6W to 24W - Duty Cycle: Intermittent operation
6	pH Sensor Driver	- Operating Voltage: 5V (typically) - Interface: Analog output (e.g., 0-5V corresponding to pH level) - Response Time: ~1-2 minutes
7	Motor Driver (12V)	- Operating Voltage: 12V - Current per Channel: Up to 2A (varies by model) - Input Control: PWM, Logic Signals - Max Voltage: 36V - Heat Dissipation: Active cooling required for higher currents
8	Bluetooth Module HC-05.	- Operating Voltage: 3.3V to 5V - Operating Range: 10 meters (Class 2) - Bluetooth Version: 2.0+EDR - Communication Interface: UART (Serial) - Data Rate: 2-3 Mbps
9	Water Tank (2 liter)	- Capacity: 2 liters - Material: Plastic (HDPE, PVC, etc.) - Dimensions: 20 x 10 x 20 cm (approx.)

Chart -2: Hardware Specifications

6. BLOCK DIAGRAM

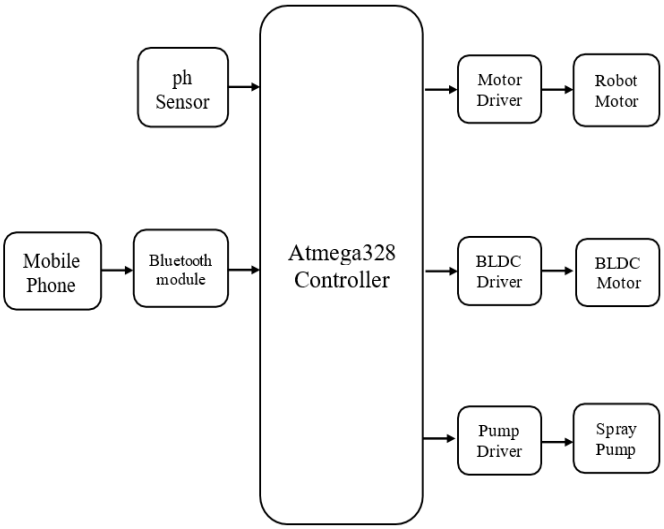

Fig -1: Block Diagram

7. CIRCUIT DIAGRAM

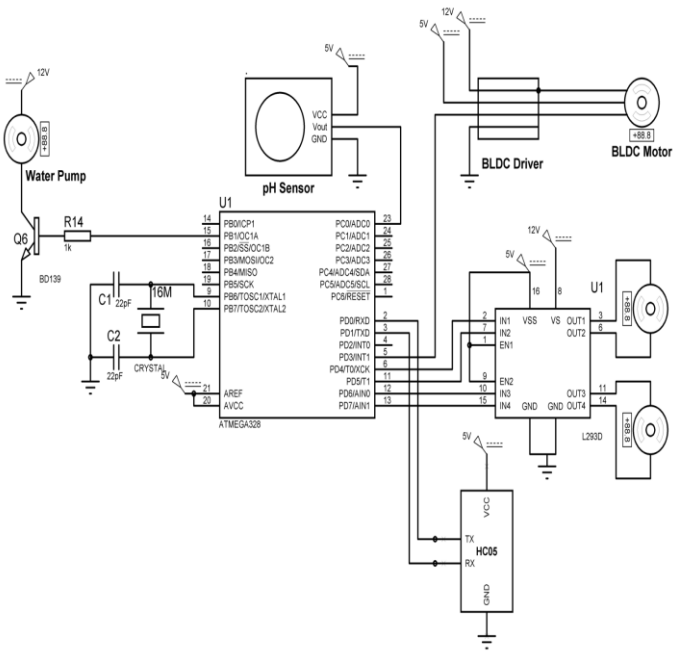

Fig -2: Circuit Diagram

8. FLOW CHART

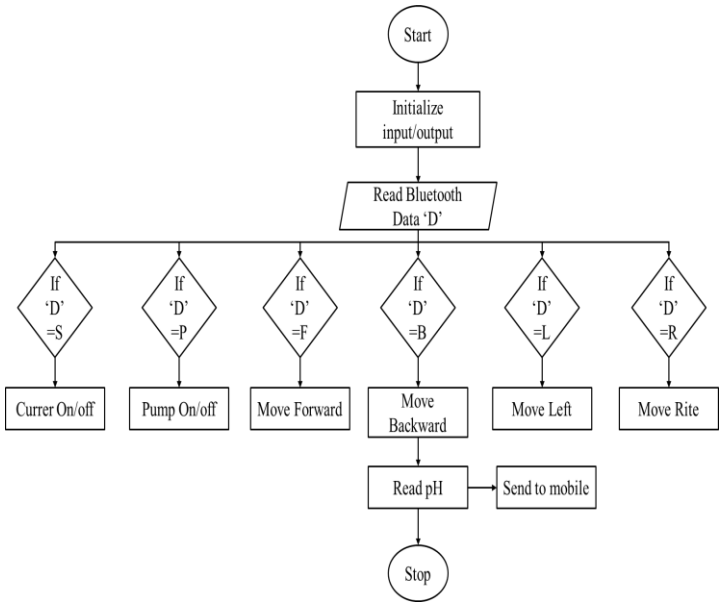

Chart -3: Flow Chart

9. WORKING

Spider Robot Structure:
The robot is designed with a spider-like structure, featuring multiple legs to traverse various terrains. It can function autonomously or be controlled remotely.
Grass Cutter Mechanism:
Fitted with blades or a cutting system to trim grass as it moves over the ground. The blades are driven by a small motor.

Pesticide Sprayer:
A tank holds the pesticide, and a pump delivers it through a nozzle. When the pH is within the ideal range (6 – 8), the robot activates a small pump to mix the pesticide with water and sprays it on the crops as it moves. The nozzle ensures even distribution of the pesticide across the crops or grass.

10. ADVANTAGES

Precision and Efficiency: It accurately targets pests and weeds, reducing chemical use and labor costs.
Safety: Minimizes human exposure to harmful chemicals by automating spraying and cutting tasks.
Versatility: Combines spraying and grass cutting in one machine, saving time and resources.
Better Plant Health: By measuring the pH of the water
Adaptability: The spider-like design allows it to navigate uneven terrain and hard-to-reach areas.
Environmentally Friendly: Reduces pesticide runoff and soil compaction compared to traditional methods.

11. APPLICATION

1. Agriculture :-
Pesticide Application: The robot can precisely spray pesticides on crops.
Weed Control: It can cut weeds and unwanted grass around crops.

2. Landscaping and Lawn Care :-
Grass Cutting: The robot can cut grass in residential gardens, commercial properties, and public spaces.

3. Greenhouses: -
Plant Health: The robot can manage pests and weeds in greenhouses.

12. RESULT

Sr.No	Parameter	Result
1	Grass Cutting Efficiency	90%
2	Pesticide Spraying Efficiency	85%
3	pH Measurement Accuracy	±0.1 pH
4	Terrain Navigation Capability	Effective on uneven terrain
5	Battery Life	4 hours on continuous operation
6	Obstacle Detection	Yes, via built-in sensors
7	Remote Control Range	10 meters
8	Chemical Usage Reduction	Up to 30% compared to manual methods
9	Time Efficiency	Reduces operation time by 50%
10	User Satisfaction	High, based on ease of use and maintenance
11	Environmental Impact	Reduced pesticide runoff and soil compaction
12	Durability	Rated for prolonged use in agricultural settings
13	Cost Savings	Significant reduction in labor and material costs

Chart -4: Result

13. CONCLUSION

The Spider Agri-Bot, which integrates a grass cutter, pesticide sprayer, and pH meter, represents a significant advancement in modern agricultural practices. By combining these functionalities, the Spider Agri-Bot enhances operational efficiency, reduces labor costs, and minimizes the environmental impact of farming. The ability to monitor the pH of water used in pesticide application ensures optimal conditions for chemical efficacy, promoting healthier crop yields. Moreover, the integration of advanced sensors

and AI technology paves the way for precision agriculture, enabling real-time data analysis and informed decision-making. As the agricultural landscape continues to evolve, the Spider Agri-Bot stands poised to play a crucial role in promoting sustainable farming practices, improving resource management, and meeting the increasing demands for food production in a more ecofriendly manner. Its development not only benefits farmers by streamlining operations but also contributes to the overall health of the agricultural ecosystem.

14. REFERENCES

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