

INVENTION REPORT

SMART ADJUSTABLE SPRAYER

GROUP MEMBERS: COL/EE/2324/F/011

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1. Introduction

In modern agriculture, efficient spraying of fertilizers and pesticides is a major challenge due to variations in crop height and crop width. Conventional spraying systems apply chemicals uniformly without adjusting to crop conditions, resulting in excessive chemical usage, uneven spraying, and environmental harm.

This project proposes a smart agricultural spraying system that automatically adjusts the spraying height and spray flow rate using sensors and motors. This system is designed to travel along crop rows and spray accurately on crops on both the left and right sides.

2. AIM

To design and develop a modern, cost-effective agricultural device that empowers small-scale farmers to automate the application of water and fertilizer, significantly saving time and reducing physical exhaustion. By integrating smartphone-based remote control, the system allows farmers to manage their crops from a single location, providing a sustainable technological solution to the current shortage of manual labor while enhancing the overall efficiency of contemporary farming practices.

3. Problem Statement

- Crop height varies at different growth stages
- Crop width is not uniform
- Manual spraying causes chemical wastage
- Fixed-height sprayers damage crops or spray inefficiently □ Farmers require a low-cost and automated solution.

4. Objectives

- To design an automatic spraying system for uniform crop coverage
- To automatically adjust nozzle height according to crop height
- To control spray flow rate based on crop width
- To reduce fertilizer and pesticide wastage

5. System Overview

The proposed system consists of a mobile platform that moves along crop rows using wheels. The nozzle pack is mounted on a vertical frame. The nozzle pack contains six nozzles for spraying.

The nozzle pack move up and down together using a stepper motor and conveyor belt mechanism. An ultrasonic sensor mounted at the lower part of the nozzle assembly measures the distance between the crop and the nozzles, enabling automatic height adjustment.

The nozzle pack is divided into three zones, and each zone is controlled by a servo motor, allowing different flow rates depending on crop width.

6. Mechanical Design (FIG 01)

- Vertical support frame for nozzle pack
- One stepper motor connected to the conveyor belt for synchronized vertical movement
- Wheels for smooth movement along crop rows
- A centrally mounted liquid tank connected to the nozzle packs □ Rigid structure to maintain alignment and stability

7. Electronic Components

- Arduino microcontroller
- Stepper motor with driver module
- Ultrasonic distance sensor
- Six servo motors (three per nozzle pack)
- DC pump for liquid supply
- Power supply/battery system

8. Working Principle

The ultrasonic sensor continuously measures the distance between the crop canopy and the nozzle assembly. When the distance changes, the Arduino controller activates the stepper motor to move the nozzle packs upward or downward, maintaining an optimal spraying height.

The nozzle pack contains six nozzles, divided into three zones. Servo motors control the flow rate of each zone independently. This allows higher spray flow in dense crop areas and lower flow at the edges, ensuring uniform and efficient spraying.

The system moves forward using wheels while spraying crops on both sides simultaneously

9. Innovative Features

- Dual-side spraying system
- Automatic height adjustment using an ultrasonic sensor
- Stepper motor-driven conveyor belt lifting mechanism
- Zone-based spray flow control using servo motors
- Reduced chemical wastage
- Suitable for small and medium-scale farming

10. Applications

- Paddy cultivation
- Vegetable farming
- Row-based crop fields
- Precision agriculture systems

11. Advantages

1. Uniform spraying
2. Reduced labour requirement
3. Lower chemical consumption
4. Adjustable for different crop stages
5. Cost-effective design

12. Conclusion

The proposed smart adjustable spraying system provides an efficient and innovative solution for modern agricultural spraying. By combining automatic height control with zone-based spray regulation, the system improves spraying accuracy, minimizes wastage, and supports sustainable agricultural practices.

BUDGET

Mechanical Structure

Item	Quantity	Approx.Cost(LKR)
Mild steel/Alluminium frame	01	1200
Vertical columns	01	300
Wheels(rubber)	04	600
Conveyor belts	01	200
Pulleys & shafts	set	300
Fasteners & brackets	set	200
Subtotal		2800

Spraying system

Item	Quantity	Approx.Cost(LKR)
Nozzels	6	300
DC water pump	01	700
Liquid tank (5-10L)	01	600
Pipes and connectors		100
Subtotal		1700

Electronics & control

Item	Quantity	Approx.Cost(LKR)
Arduino UNO(or compatible)	01	1000
Stepper Motor(NEMA 17)	01	700
Stepper motor driver	01	300
Servo motors	01	150
Ultrasonic sensor (HC-SR04)	01	300
Relay/motor driver	01	300
Wires,PCB,Connectors	set	250
HC-05 Bluetooth Module	01	600
Motor Driver	01	300
DC Motors	04	1000
Battery	01	500
Wires/Connectors	set	50
Slide switch	01	30
Subtotal		5480

TOTAL PROJECT COST

Category	Cost(LKR)
Mechanical System	1365
Spraying System	2485
Electronics & Control	6760
TOTAL ESTIMATED COST	10610

Supervised by:

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Date:.....

Signature