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Design and Fabrication of Pesticide Series Spraying Machine for Multiple Agricultural Crops

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Abstract: ***Sprayer is device used to spray liquid. In agriculture, sprayer is a piece of equipment that is used to apply pesticides on agricultural crops. Mainly, the general spraying technique uses hand operated and power sprayers with backpack.By using existing pesticide sprayers very less area is covered while spraying and hence more time is required to spray the entire land and also some existing sprayers are required petrol or diesel as a fuel so that the labour cost of the sprayer is also high. Some series sprayers the pipe line is not rotated in 360 deg and discharge is also very low (Q< 0.9litter/min). To overcome the above problems the present work deals with the design and Fabrication of pesticide series sprayer with the feature of 360 deg. pipe rotation and adjustable pipe length. In this work the model was designed by using CATIA and fabrication was carried out by different techniques. Real time testing was carried out at different agricultural crops.***
Key words: Pesticide Series spraying machine, CATIA.

I. INTRODUCTION

In India 70% people lives in rural areas and main source of their income is forming. In this regard have to make agricultural machine that can help to save their time. Present in agricultural field sprayers are used. These sprayers are hand operated and power operated. According power operated this paper introduced a sprayer is called as series sprayer. This sprayer consists of tank, battery, submerged pump, pipe and nozzles. The battery and submerged pump are incorporated in thank at the bottom. Numbers of nozzles are located on trough out length of the pipe in series way. This pipe connected to outlet discharge of pump trough robber hose.

II. LITERATURE REVIEW

ShaileshMalonde et.al. (May-2016):They developed a multipurpose pesticide spraying machine based on solar panels .It gives maximum work output with minimum effort.The arrangement of nozzles is adjustable according to the crops and this alone pump can used for multiple crops[1] .DhirajN.Kumbhare et.al. (Apr-2016): They developed a automatic tricycle operated pesticide spraying machine seems an alternative concept it work efficiently with respect to covering area time[2].SwapnilL.Kolhe et.al. (Feb-2014): They developed a eco friendly mechanically operated multipurpose spray pump in this nozzles can be adjusted[3].

III. METHODOLOGY

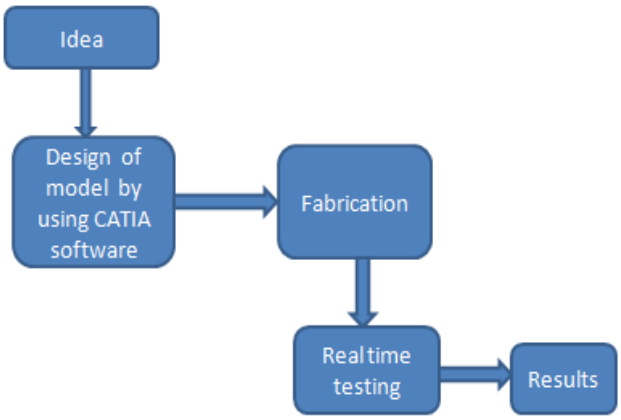

Fig.1. Process flow chart

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A. Line diagram

The line diagram consists of the following components.

1.Tank, Battery, Submerged motor, Frame, Discharge pipe, Nozzles. All the components are shown in figure 2.

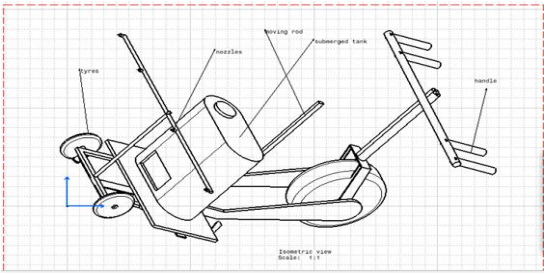

Fig.2. Line diagram of the proposed model

B. Assembly:

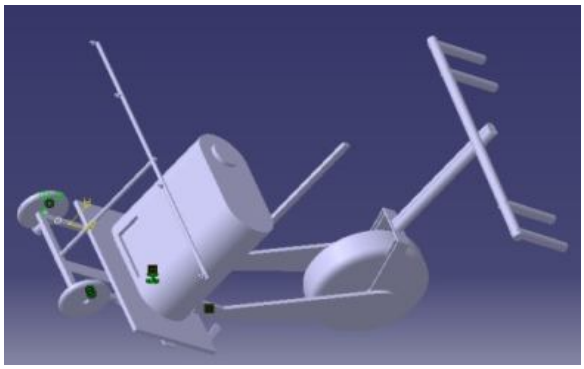

Fig.3.assembly

C. Fabrication

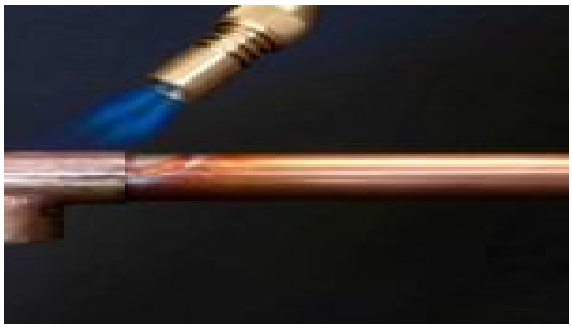

Fig.4. Pipe welding

Fig.5. Wheels Attachment

Fig.6. Frame welding

Fig.7. Handle Fitting

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Fig.8. Prototype

D. Specifications

1) Diameter of front wheel : 0.18m
2) Diameter of rear wheel : 0.60 m
3) Tank capacity : 16 lit
4) Lenght of base : 0.80 m
5) Pipe lenght : 1.5 m
6) Battery : 12V
7) Diameter of handle pipe :0.09 m
8) Motor capacity :2.2 A
9) Charging time :3hr
10) Battery Duration time :7hr

E. Calculations

1) Power = energy per second
2) Battery 12Ah current,12V
3) Power=V × I =12×12 = 144W
4) Total power stored in battery = 432 WH
5) Flow rate of nozzle

$Q_n=28.9 \times D^2 \times \sqrt{P}$

Where Q_n= flow rate of water from nozzle(gpm)
D=Nozzle diameter(inch)
P=Pressure at nozzle (psi)

F. For Nozzle 1

Diameter of nozzle=1.1mm=0.0433inch
$=28.9\times(0.0433)^2\times\sqrt{25}$
=0.2699 gpm
=1.02lit/min

G. For Nozzle 2

Diameter=1 mm=0.0393 inch
$Q_n=28.9\times(0.0393)^2\times\sqrt{25}$
=0.223 gpm
=0.84 lit/min

H. For Nozzle 3

Diameter=0.9mm=0.035433inch

$Q_n=28.9\times(0.0354)^2\times\sqrt{25}$
=0.181 gpm
=0.68 lit/min

IV. REAL TIME TESTING

Fig.9. Testing in wet land crops

Fig.10. Testing in dry land crops

V. RESULT AND DISCUSSIONS

Discharge was calculated at different sizes of the nozzles, at different speeds. In real time testing spraying time was calculated between conventional sprayer and series sprayer. Cost of energy consumption of conventional and seriessprayers were calculated.Spraying was performed in both wet and dry lands of agricultural crops and depends up on the requirement of sprayer discharge pipe is rotated along 360 deg. The following tables give the test results.

Table1. Labour cost estimation for conventional sprayer

S.No	Fuel Used	Cost of the fuel	Area Covered	Time(hr)	Labour Cost
1	Petrol	73.16 Rs	5 Acrs	5.50	1 Acr=400/- 5 Acrs=1500/-

Table2. Labour cost estimation for series sprayer

S.No	Input	Cost of electricity	Area Covered	Time(hr)	Labour Cost
1	Electrical energy	12.36Rs	5 Acrs	3.46	1 Acr=400/- 5 Acrs=1500/-

Table3. Discharge Vs Nozzles

S.No	Type of the nozzle	Image	Controller of series sprayer	Actual Discharge (Litter/min)	Total discharge time taken for 16 litters pesticide(min)
1	Flower		Low	0.80	21.41
			Medium	0.89	18.51
			High	1.00	16.51

2	Rain Drop		Low	0.78	21.47
			Medium	0.82	20.47
			High	0.90	17.47
3	Flat Fan		Low	0.58	23.35
			Medium	0.71	20.56
			High	0.82	19.51

Table.3.The rotation of discharge pipe in different directions

Fig.11. 90 degress right side rotation of pipe

Fig.12. 90 degress left side rotation of pipe

Fig.13. forward direction of pipe

VI. CONCLUSION

The model was designed by using CATIA software and fabrication was done by using different joining process. Labour cost estimation was compared between conventional sprayer and series sprayer. Discharge was calculated at different size of the nozzles and different speeds.

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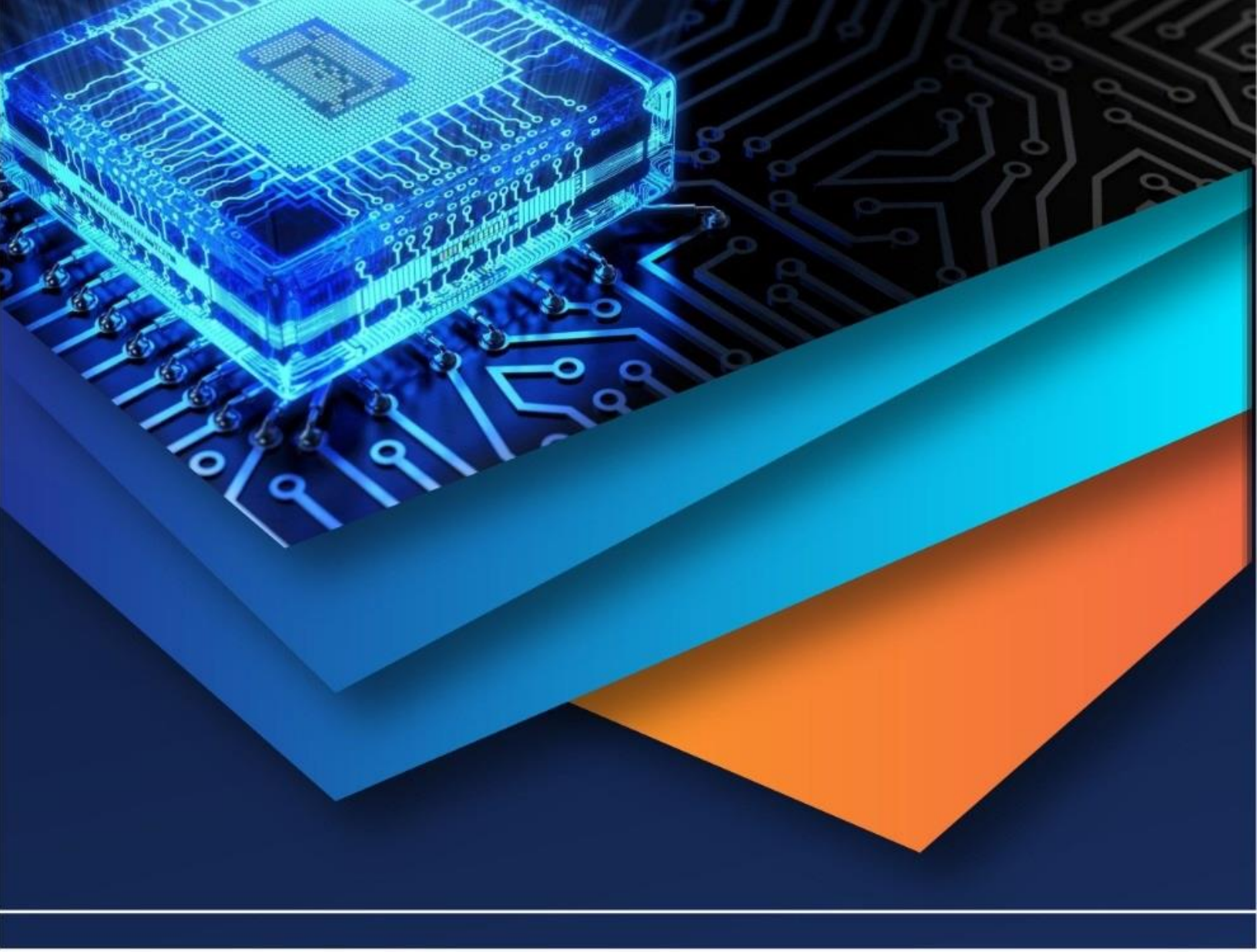

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