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ROAD DIVIDER PAINTING MACHINE

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Abstract - *The primary aim of the project is to design, develop and implement Automatic road divider painting machine which helps to achieve low cost painting equipment. Despite the advances in robotics and its wide spreading applications, interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. When construction workers and robots are properly integrated in building tasks, the whole work can be better managed and savings in human labour and timing are obtained as a consequence. In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time. These factors motivate the development of road divider painting machine.*

Key Words: *solar panel, electronic circuit, automation.*

1. INTRODUCTION

The primary aim of the project is to design, develop and implement semi-automatic road divider painting Machine which helps to achieve low cost painting equipment and safety.

The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also then nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. When construction workers and machine are properly integrated in building tasks, the whole construction process can be better managed and savings in human labor and timing are obtained as a consequence.

In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time. These factors motivate the development of an automated painting system.

2. LITERTURE REVIEW

P. Keerthanaa, K.Jeevitha[1]

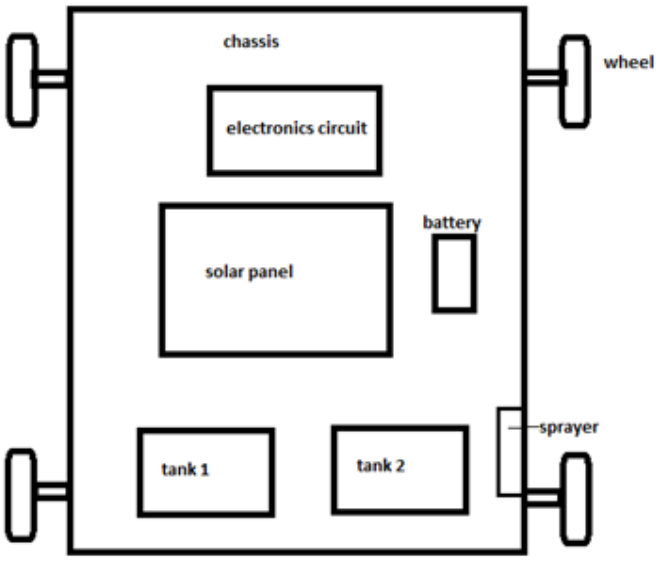
The primary aim of the project is to design, develop and implement Automatic Wall Painting Robot which helps to achieve low cost painting equipment. Despite the advances in robotics and its wide spreading applications, interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming.

Andhale Satish1, Ansari Md [2]

The aim of the project is to design, develop and implement Automatic Wall Painting Using Lead Screws which helps to achieve low cost painting device. The chemicals used in painting can be hazardous to human health eye and skin infections. Also conventional painting is time and effort consuming, and also the method of operation (rising hand again and again for painting) makes it boring. These factors motivate the development of an automated painting system.

3. SYSTEM DESCRIPTION

3.1Working diagram



3.2 CONSTRUCTION

The system contains mechanical parts of frame made of L angle, plywood, wheels, wiper motor, handle, tank, hose pipe, water motor, solar panel, battery and electronics components like microcontroller, relay, switch . Frame of L angle is fabricated on which plywood is assembled. Two tanks are used for the two different colors for black and for yellow which are placed on plywood.

The whole system is automatically movable by using wiper motor. Solar panel is connected to the assembly which is used to store solar energy in battery. This stored solar energy is supplied to the electronics circuit working.

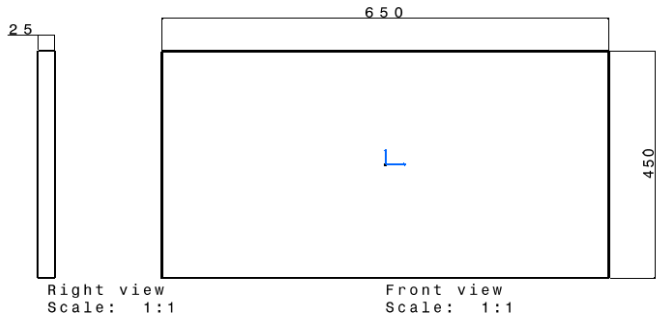
4. CALCULATION AND CAD MODEL

Total weight of the system-weight of tank+plywood+solarpanel+watermotor+electronicscircuit+s

1.Design of frame:

Specification:

Mass=6kg(here total 6kg weight acted on frame)
Here weight acting on middle side of frame therefore here consider perpendicular distance=325mm



*(*Formulas are taken from khurmi gupta-reference book*)*

- $\frac{M}{I}=\frac{\sigma b}{y}$ ……..**(1)**

➢ **Bending moment(M)=force *perpendicular distance**

=6*325*9.81

Bending moment(M)=19129.5 Nmm

Here we are finding the value of moment of inertia:
Therefore taking the value of angular frame;

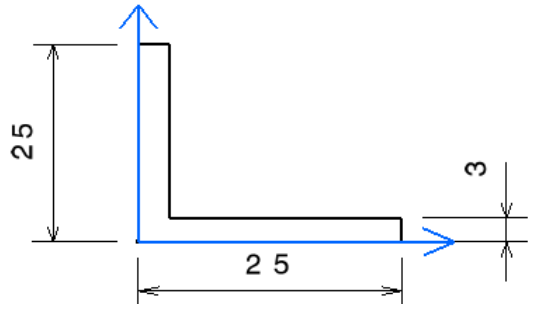


Fig.-angle

b=25mm
h=25mm

$$I=\frac{b(h^3)}{12}$$

$$=\frac{25(25^3)}{12}$$

I=32552.08mm4

$$Y=\frac{b}{2}=\frac{25}{2}=12.5$$

Therefore above value use in equation no(1)

$$\frac{19129.5}{32552.08}=\frac{\sigma b}{12.5}$$

Therefore,

σ_b=7.34Nmm

7.34<105
Hence design is safe.
Water pump
According to spraying capacity & discharge capacity of spray pump is selected.
Let,
Voltage-8 to 12 volt
Maximum lift-130cm
Suction head, h_s=
Discharge head,$h_{d=}$
suction pipe diameter=12mm
discharge pipe diameter=8m

All formulae refrance from(Design and Fabrication of Solar Operated Sprayer for Agricultural Purpose

National Conference on Innovative Trends in Science and Engineering (NC-ITSE'16) ISSN: 2321-8169 Volume: 4 Issue: 7)

overall efficiency of the pump

$$\eta=\frac{w*Hm}{1000}/s.p$$

$$s.p=\frac{\rho g Q Hm}{1000}$$……..**(1)**

let,

ρ=density of water
g=9.81
s.p=power require to drive the pump
H_m=manometric head

$$H_{m=}(\frac{Vd^2}{2g}+3)-(\frac{Vs^2}{2g}+0.5)$$

V_d=velocity at discharge
V_s=velocity at suction

$$V_d = \frac{\text{discharge}}{\text{area of delivery pipe}}$$

Consider discharge

$Q = 1.66*10^{-5}\ m^3/sec$

$A = \frac{\pi}{4}*(0.0075)^3$

$V_d = \frac{1.66*10^{-5}}{\frac{\pi}{4}*10^{-3}}$

$V_d = 2.81*10^{-3}$ m/sec

$$V_s = \frac{\text{discharge}}{\text{area of suction pipe}}$$

$V_s = \frac{1.66*10^{-5}}{\frac{\pi}{4}*12^{-3}}$

$V_{s=12.26*10^{-3}}$ m/sec

$H_m = 3+\left(\frac{2.81*10^{-3}}{2*9.81}\right)-0.5+\left(\frac{(12.26*10^{-3})^2}{2*9.81}\right)$

$H_m = 12.26$ m

We know that overall efficiency consider uptonη=60%
Put all values in equation (1)

Therefore, $\mathbf{s.p} = \frac{\rho g Q H m}{1000*\eta}$

$= \frac{1000*9.81*1.66*10^{-5}*12.26}{1000*0.6}$

s.p=3.27 watt

DC motor selection

Specifications
Voltage =12v
Current=7.5 amp
Application-90 degree steering
Voltage=current*resistance
12=7.5*R
R=12/7.5
R=1.62 ohm
The major constraint on motor operation is thermal
$P_{dis} = I^2*R$
Heat Heat dissipated= current through the motor squared, multiplied by the terminal resistance
P_{dis}= (7.5)^2*1.6
P_{dis}= 90
force required to move
weight on motors 4 kg and dead weight 2kg
total weight on motor 6 kg

F=6*9.81
=58.86 N
Torque required for motor
T=f*r
Assuming wheel radius 75 mm
T=58.86*0.075
T=4.42 Nm
T=4420Nmm

POWER:

$p = \frac{2*\pi*N*T}{60}$

$P = \frac{V2}{R}$ (where v= 12 volt, and R= resistance 1.62)

$= \frac{12^2}{1.62}$

P=88.8888watt
P=90 watt

TO FIND RPM OF MOTOR:

Therefore;

$\mathbf{p} = \frac{\mathbf{2*\pi*N*T}}{\mathbf{60}}$

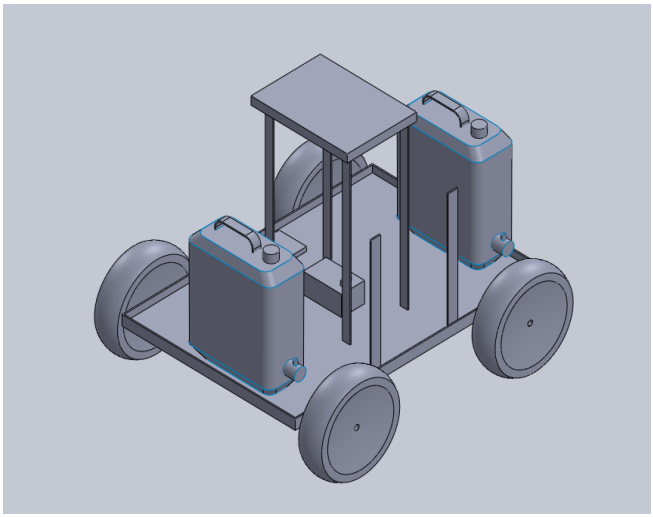
$90 = \frac{2\pi*N*4.42}{60}$

N=194.44
rpm.....maximum

Specifications

RPM=100rpm
5 kg torque-DC motor
Voltage-12v

CAD MODEL



5.ADVANTGES

1. Simple in construction
2. Solar energy is used which is available free of cost
3. Automatic system
4. Does not required skilled labor.
5. Can reduce the time for painting work
6. Avoid issues due to the painting spraying to human health.

CONCLUSION

- The robot eliminates the hazards caused due to the painting chemicals to the human painters such as eye and respiratory system problems and also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming.

- The robot is cost effective, reduces work force for human workers, reduces time consumption.

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