iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6025

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Design & Fabrication of Wall Painting Machine

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Abstract: 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, 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 construction process can be better managed and savings in human labor and timing are obtained as a consequence.
Keywords: Wall painting machine, Lead screw & nut, Motor, Painting roller.

I. INTRODUCTION

Building and construction is one of the major industries around the world. In this fast moving life construction industry is also growing rapidly. But the labors in the construction industry are not sufficient. This insufficient labor in the construction industry is because of the difficulty in the work. In construction industry, during the work in tall buildings or in the sites where there is more risky situation like interior area in the city. There are some other reasons for the insufficient labour which may be because of the improvement the education level which cause the people to think that these types of work is not as prestigious as the other jobs.

The development of an autonomous robot for painting the walls of buildings. The robot consists of a painting arm with an end effector roller that scans the walls vertically and a mobile platform to give horizontal feed to paint the whole area of the wall. The painting arm has a lead screw and nut mechanism. Lead screw are driven from a stepping motor through a coupling mechanism. Spring mechanism is used to maintain contact between wall and roller. The quantity of paint is maintained with the help of flow control valve for better quality of painting. 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. These factors motivate the development of an automated robotic painting system. There have been few research projects in the literature but they did not produce a mature system acceptable by the market yet. More than 100,000 apartments are built annually in Egypt, with an average painting area of 40 million square meters (based on an average 100 m2 apartment area with 400 m2 painting area). The surface area of painting is more due to the renovation work and expected population increase in the future. This demand imposes challenges that will hardly be met using human painters only in the next decade. Therefore development of a Painting machine that can perform the painting task with minimum human intervention is needed and will improve the quality of painting. The need for an autonomous painting robot is both clear and strong. Automated painting had been realized successfully in the automotive industry to paint millions of cars in the assembly lines. This industry uses spray painting and the robotic system is fixed in the assembly line. The domestic painting robots should be different in the sense that robots should have mobility so that it can move to paint the fixed walls. Also, the domestic painter robots should use roller instead of spray which is the common practice in the market to attain customer satisfaction.

II. SELECTION OF COMPONENT

Based on the literature survey and availability, we have listed the required components of the electric vehicle.

A. Mobile platform

1) Frame stand
2) Wheel
3) Sliding mechanism
4) Lead screw and Nut
5) AC motor
6) Control unit

B. Paint Feed Mechanism

1) Paint tank
2) Roller with internal pipe

C. Frame

1) *Material:* Mild Steel

The frame stand is the steel bolted in such a way that itcan carry the whole equipment. Vertical members willcarry the mobile platform consisting Components likecompressor, nozzle, paint tank &motor.This mobile platform will be connected to vertical members of frame by vg tyjkmrollers to allow the up-downmotion to platform controlled by pulley rotation.Four wheels are attached to the frame stand inorder to move the machine in the direction specified.The movement of these wheels are controlled by the DC motor rotation which is controlled by the controller.

D. Lead Screw Selection

Lead screws use the helix angle of the thread to convert rotary motion into linear motion. To determine the lead screw and nut combination for your linear motion application, the following interrelated factors must be identified and considered:

1) Axial load measured in pounds or newtons
2) Speed measured in inches or millimeters per minute
3) Length between bearings measured in inches or millimeters
4) End fixity type

The loads that need to be considered are the static loads, dynamic loads, reaction forces and any external forces affecting the screw.

a) *Static Load:* The maximum shock load that should be applied to a nonmoving acme nut assembly. Actual maximum static load may be reduced based on end machining and screw mounting hardware.
b) *Dynamic Load:* The maximum recommended thrust load which should be applied to the lead screw and nut assembly while in motion.
c) *PV Load:* Any material which carries a sliding load is limited by heat buildup caused by friction. The factors that affect heat generation rate in an application are the pressure on the nut in pounds per square inch of contact area and the surface velocity in feet per minute at the major diameter. The product of these factors provides a measure of the severity of an application

Figure 1: Lead screw

E. AC MOTOR

In high-performance systems, with high accelerations, interconnecting shafts and couplings may deflect under the applied torque, such that the various parts of the system may have different instantaneous velocities that may be in opposite directions. Under certain conditions, a shaft may go into torsional resonance. The major limiting factor in the performance of iron-cored motors is internal heating. This heat escapes through the shaft and bearings to the outer casing, or through the air gap between the armature and field magnets and from there to the casing. Both of these routes are thermally inefficient, so cooling of the motor armature is very poor.

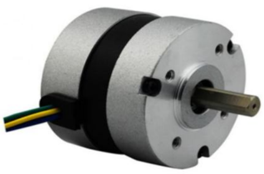

Figure 2: Ac motor

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III. CALCULATIONS

A. Data

D = Outer dia = 16mm
dc = Inner dia = D- (addendum + dedendum)×p = 12mm
μc = 0.175
μs = 0.25
α = Helix angle
φ = Angle of friction dm = (D+d)/2 = 14mm

B. Torque Required to Raise the Load

1) To Overcome Friction

T1 = P ×dm/2
T1 = w tan (α + φ) × dm/2
tanα = P/πd
tanφ = μ/cosβ
T1= 295.04 N-mm

2) Wear Condition

T2 = μc × Rm × W……… [μc = 0.175]
T2= 144.20 N-mm
Total torque
T = T1 + T2
T= 439.247 N-mm

3) Power Requires

P = T × w……….[for N=1440 rpm]
P= 66.23 Watt

C. Torque Required To Lower The Load

1) To Overcome Friction

T1 = P ×dm/2
T1 = w tan (α - φ) × dm/2
T1 =138.04 N-mm

2) Wear Condition

T2 = μc × Rm × W……… [μc = 0.175]
T2 = 144.20 N-mm
Total torque
T = T1 + T2
T = 282.247 N-mm
Power requires
P = T × w………………[for N = 1440 rpm]
P = 42.56 Watt

D. Stresses in screw

1) Bending stress

σb = W/Ac
= 117.72/113.09 = 1.04 N/mm^2

2) Shear stress

τ = 16T / π(dc)^3
= 16×284.16 / π×(12)^3
= 1.29 N/mm^2

E. Max. Bearing Pressure

Pb = W / π×d×t×n   t = P/2 = 2

Pb= 0.2230 N/mm^2   n = height of nut/pitch of nut 28/4= 7

IV. RESULTS

Table 1: Result

Speed (rpm)	Power to raise the load (watt)	Power to lower the load (watt)	Time required for single stroke (mm/sec)	Remark
1000	45.99	29.55	79.37	Thick painting at low speed
1200	55.19	35.46	95.25	Good quality of paint at moderate speed
1440	66.23	42.56	114.3	Thin painting at high speed

V. CONCLUSION

With this mechanism it will be possible to avoid the risk of painting tall buildings at elevated height. The machine is specially designed for painting the flat wall of structure.

It eliminates the hazards caused due to painting chemicals to the human painter such as eye and respiratory systems problems and also the nature of painting procedure that requires repeated works and hand rising makes it boring, time and effort consuming. The machine is cost effective, reduces work force for human workers and reduces time consumption.

REFRENCES

[1] DhavalThakar, Chetan P. Vora ―A Review on Design and Development of Semi-Automatic Painting Machine‖ Int. Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 4, Issue 4(Version 7), April 2014.

[2] Jitendra N. Shelar, Prof. N. R. Gilke ―Conceptual Design Of Fixture For Automate Exterior Wall Painting And Design And Analysis Its Main Component‖ International Journal of Innovative Research and Development, Vol 2 Issue 5, May 2013.

[3] Mohamed Abdellatif ―Design of an Autonomous Wall Painting Robot‖ Mechatronic and Robotic Dept. Egypt-Japan University of Science and Technology, Alexandria, Egypt, 7 February 2016.

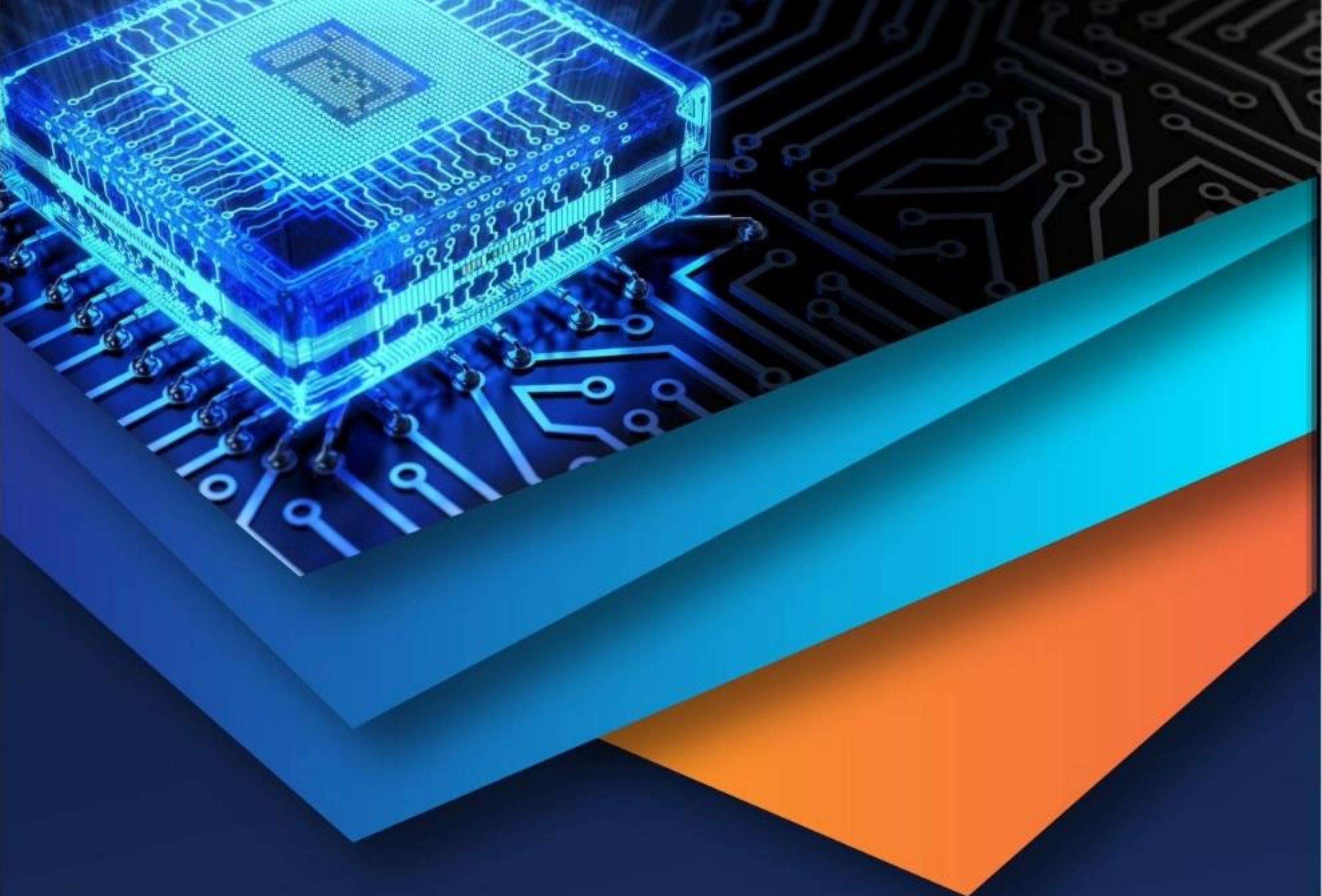
[4] BerardoNaticchia, Alberto Giretti and Alessandro Carbonari, ―Set UpanAutomated Multi-ColourSystem for Interior Wall Painting, Advanced Robotic System. [17]

[5] Selvamarilakshmi D*, Gajendran S, Muralidharan G. ―DESIGN AND FABRICATION OF WALL PAINTING ROBOT‖ Inter National Conference on Energy Efficient Technologies for Automobiles (EETA' 15), ISSN: 0974- 2115.

[6] R. S. Khurmi& J. K. Gupta - Machine Design- Eurasia publishing house New Delhi, 14th Edition, 2008.

[7] Theory of Machine –Rattan S.S Tata - McGraw Hill Publishing Company New Delhi, 2nd Edition, 2006.

[8] K Mahadevan and Balaveera Reddy- Design Data Hand Book- CBS Publication, 3rd Edition, 2010



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