DESIGN & FABRICATION OF REMOTE OPERATED 3-AXIS SPRAY PAINTING MACHINE

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ABSTRACT

Painting is a process of applying paint on surface of any object or wall. But wall painting is time and effort consuming process. It is also hazardous, boring and exhausting technique which makes it an excellent case for automation. Painting had been automated in most of automotive industry but not yet for the construction industry and also for the house wall painting. There is a strong need for a movable robot that can move to paint interior walls of household buildings. In this paper, the conceptual design of remote operated wall painting robot is described consisting of an electric spray gun that paint the walls vertically and is fitted on a movable robot base to give the linear feed motion to cover the painting surface. The design objective is to fulfill the foundation of simplicity, easy handling, low cost, reducing human effort and constant painting. IR sensors are fitted to adjust the distance limits and maneuver in the room area. A remote operated system is designed to guide the vertical motion of electric spray gun with the help of lead screw and electric motor. Also plan to move the base in horizontal direction.

Keyword: - *boring and exhausting techniques, remote operated, IR sensor, electric spray gun.*

1.INTRODUCTION

Building and construction is one of the important industries around the world. In this fast moving life construction industry is also developing expeditiously. But the labours in the construction industry are not sufficient. This inadequate labours in the construction industry is due to the complexity in the work. In construction industry, during the work in giant buildings or in the sites where there is more dangerous situation like interior area in the city. There are some other reasons for the unsatisfactory labours which may be because of the improvement the education level which cause the people to think that these types of work is not as esteemed as the other jobs. The construction industry is labour-intensive and conducted in risky situations; therefore the importance of construction robotics has been realized and developed at speed. Applications and activities of robotics and automation in the construction industry started in the early 90's aiming to upgrade equipment operations, improve safety, modify concept of workspace and furthermore, ensure quality environment for building occupier. After the advances in the robotics and automation the construction industry has developed very fast. In contempt of the advances in the robotics and its wide spreading applications, painting is also considered to be the tough process & it also has to paint the whole building. To make this work easier, secure and also to reduce the number of labors the remote operated spray painting machine was introduced. Above all these the interior wall painting has shared slight in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system. Also the nature of painting procedure that requires recast the work and hand rising makes it tedious, time and effort

consuming. These factors inspire the development of remote operated spray painting machine. This project aims to develop the interior wall painting robot which is remote operated. This Three Axis Spray Painting Machine is not designed by using problematic components. This robot is simple and movable. The robot is designed by using few steels, steel rods, spray gun, electric motor and a controller unit to handle the entire operation of the robot. This robot is compact due to moderate speed and pressure capabilities they have. They also have a small weight to power output ratio and expected performance i.e. losses are minimum due to less number of moving parts are use in this machine and so gives expected performance. Due to elegant and simple control systems it can control noise, vibration and does silent & decent operation and small amount of vibration is produced. It has longer life, flexibility, efficient and trustworthy. The installation and maintenance is easy. Some of the conditions that have to be examined while using this robot is that the system is operates, so it needs airless spray gun and plastic barrel etc.

2.REVIEW OF LITERATURE

Mohamed Abdellatif In this paper author describe the design and working of an autonomous wall painting robot. The conceptual design of a movable painting robot to be used for painting interior walls of residential building had been described. The robot uses roller fed with liquid paint and keeps contact with the wall surface. The robot enables the roller to scan vertically as well as horizontally to the painted walls. The robot can maneuver to adjust itself in front of the wall. **[1]**

Dhaval Thakar, Chetan P. Vora This paper gives basic information about small and medium scale industries manufacturing components have to paint for protecting from rusting so the spray application consumes maximum time and paint which required the skilled worker emerged with the application. They cannot manage robotic arrangement for higher efficiency so the rise of the such process have to be made which is affordable, gives better accuracy, consumes minimum time for coating so objective has to developed such mechanism which coat the object with the dipping technique having semi-automatic arrangement which is suitable for our requirement and which can be valuable for small and medium scale industries. **[2]**

P.Keerthanaa, K.Jeevitha, V.Navina, G.Indira, S.Jayamani They studied that automatically paint the wall surface of given dimension has been designed and implemented in effective manner. The approach uses Infrared transmitter and Infrared receiver to identify the appearance of wall. The microcontroller unit to regulate the movement of the DC motor. The robot wipe out the hazards caused due to the painting chemicals to the human painters and also the nature of painting techniques that require imitated work and hand rising makes it dull, time consuming. The robot is cost effective, reduces work force for labours, reduces time consumption. The drawback of the project is that the robot continues painting later the end of the wall so it can be eliminated by adding some indicating objects such as alarms. **[3]**

Berardo Naticchia, Alberto Giretti and Alessandro Carbonari In this paper, they shown that automated painting can be not only aimed at correcting productivity, but also quality checking. A robot arm with high precision is required. An automated system to convert the normalized coordinates of the liquid colors to be reproduced into the movement speed of the robot end tool and valve opening end of the mixing board. Most of the work will be probably necessary to achieve high resolution. Because of the shape of full scale robots, probably also the resolution of the human scale robot will be lower. Another particularity of the small scale arrangement is of course the ability to access some hard places of buildings under construction, where human range robots could not be allowed. **[4]**

Takuya Gokyu, Masayuki Takasu, Sumio Fukuda They have shared that construction of Wall-Surface Operation Robot plan to automate and increase the efficiency a series of restoration works by adding, changing of an attachment, new task for cleaning. Tile separation sensing and repair work to the initial functions of picture painting in a single and multiple colors is also done. The analysis of this example was introduced as a periodic inspection of the 10th year for the office building concerned. And, high profitability is expected because of presence of many similar structures. **[5]**

Pål Johan & Jan Tommy Gravdahl In this paper, they present a technique for increasing the speed at which a standard industrial manipulator can paint a wall surface. The approach is based on the perception that a small error in the direction of the end effector does not influence the quality of the paint job. It is far more important to maintain constant velocity throughout the orbit. In doing this, they cast the problem of finding the optimal orientation at each time step into a convex minimized problem that can be solved efficiently and in real time. They show that aim to allows the end effector to keep higher constant velocity throughout the orbit guaranteeing constant paint coating and substantially decreasing the time needed to paint the wall. **[6]**

3. OBJECTIVE

In this technical world, there is a strong requirement of automatic execution of all work. Humans avoid getting actually involved in the task; rather find machines to carry out our designated work. The definite targets for improvement of the wall painting robot, in order to solve the antecedent situation, were set as follows:

1. To minimize human efforts the machine is operated by remote control.
2. To reduce time requirement for painting, spray gun is used.
3. To improve safety by eliminating work on scaffolds.
4. To control the wastage of paints.
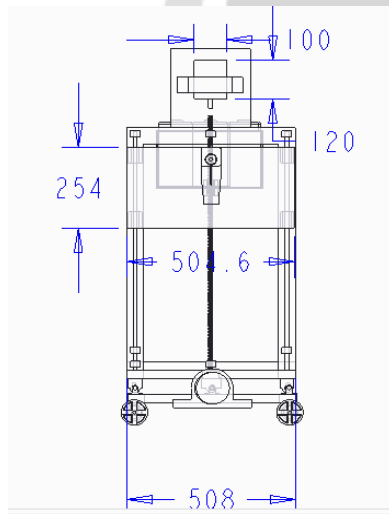5. To make machine structure simple to enable easy mounting.
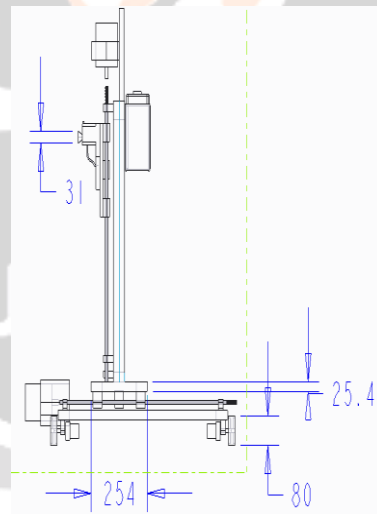
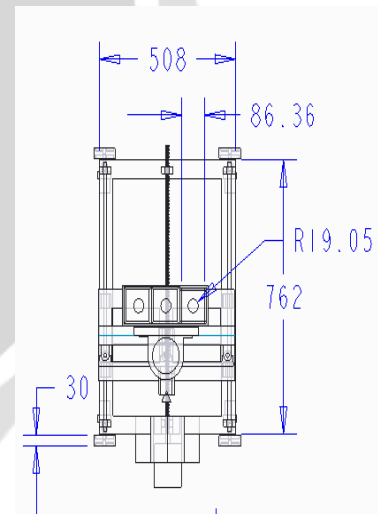## 4. 2-D MODEL

Fig.4.1 front view   Fig.4.2 side view   Fig.4.3 Top View

5. 3-D MODEL

6. WORKING

In the Remote Operated 3-Axis Spray Painting Machine, to start the system switch ON the power supply with the help of 35v charger which connected to the dc machines to drive the robot. When the robot is stared, system gets initialize. Now the system can move in x-axis with the help of basement wheel mechanism system. After performing this operation, spray gun can move in y-axis easily with the help of next steel frame and steel threaded rods. When system is in x and y axis 70% surface can be cover. The spray gun in z-axis can adjust to spray on surface of the wall and it can execute with the use of color barrel and threaded steel rod. One best feature is that a IR sensor, it will detect the perfect position of wall where machine can paint, it means it will detect the particular distance of paint. In this way, the whole operation can perform easily and safely.

7. SPECIFICATION OF COMPONENT

Table -1

Sr. No.	Name of Component	Specification
1	Threaded Rod	Length:1 m Diameter:12 mm
2	Spray Gun	Max. delivery rate:0.26 Lts/min Operating Voltage:220/230V
3	Motor	RPM:100 Operating Voltage:12V DC
4	Wheel	Diameter:6 inch
5	Switch	2 way
6	Connecting wires	For Remote & Chassis
7	Battery	Operating Voltage:12V, 7 Amp
8	Electric Spray Gun	Operating Voltage:230V DC
9	Fixture	Diameter:12 mm
10	IR sensor	Detect the presence of wall

7.1 COST OF SETUP

The total cost of the setup is Rs.16,570 i.e the cost of the raw material, spray gun and electrical motor is nearly equal to Rs.11,000 . Fabrication cost is about Rs.3,000. Other ingredient used cost is Rs.2,570.

8. ADVANTAGES

(1) It consume less time and electricity.

(2) Installation cost is moderate.

(3) Weight of the design is not more than 19 kg. So it can be portable from one place to another.

(4) Due to the use of wheel and motor it can be move in horizontal and vertical direction.

(5) It minimizes the wastage of color.

9. CONCLUSIONS

The technique of remote operating 3-axis spray painting machine is presented here which shows better supplementation between man & machine. The IR sensor is used to detect presence of wall & also to adjust the distance between wall and machine.
In the future, we would like to expand features & application of the painting robot by using image processing in order to scan the objects and obstruction that are present in the wall so that the painting can be completed in graceful manner.

10. REFERENCES

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BIOGRAPHIES

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