Automation in Wall Painting Robot

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Abstract – Although the use of spraying robotized systems for interior painting was already shown to be feasible and convenient, a lot of experiments must be carried out in the future to deliver a highly autonomous robot for interior painting. 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. When construction workers and robots are properly integrated in building tasks, the whole construction process can be better managed and savings in human labour and timing are obtained as a consequence.

Index Terms – Automatic wall painting robot, Construction field, Painting robot, Highly autonomous robot.

1. INTRODUCTION

As shown by some feasibility analyses relative to the automation of interior finishing construction processes, there are both economic and qualitative factors that could justify the adoption of robotized systems. Savings in human labor and in timing are only the two main advantages; besides them we must consider the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, and to improve the quality of such works. Valuable experiments were led in ref. [1] to verify how convenient is carrying on interior-finishing works through robots. In particular, painting was executed using a spray gun with its on/off control nozzle operated by connections of the multipurpose TAMIR robot's controller. Results of comparisons at full scale between labor and robotized execution showed that there are significant

savings in labor, depending on the labor rate, when auxiliary work is considerably lessened.

The same robot TAMIR was used for other experiments more deeply concerned with painting in ref. [2, 3], where the degree of human and robot integration is studied, in order to develop very efficient robots, through the description of the break-even point that makes automation more convenient than labor. Through the performance of full scale experiments, it was possible to show that robots are always more profitable than human work when highly autonomous robots are adopted, because one operator may supervise also two different robots; in this way it is convenient also for cheap labor markets. This is due to the fact that human workers are released to the simultaneous performance of complementary subtasks, which might improve the profitability of the system.

The feasibility of highly autonomous robots is shown by a number of papers, thanks to the adoption of navigation systems that can be implemented inside controllers, in order to reduce auxiliary work from labor. In ref. [4] a prototype of highly autonomous plastering robot was tested in a full scale construction site: it is able to measure the size of the environment and to execute its operations autonomously, under the control of an operator, using range measuring sensors scanning in one or two planes. Even if good results were obtained inside a room, further sensors would be needed to perform the same operations in an apartment or in whole buildings. The time used for plastering the walls and ceiling in a room is expected to be less than 50% of that required by manual work and the amount of plaster used is greatly reduced. More accurate and advanced navigation systems were sown in ref. [5] and [6]: the former is relative to preliminary application of the range-weighted Hough transform, while the latter is

relative to an algorithm for environmental mapping by integrating scans from a time-of-light laser and odometer readings to produce data from which approximated lines were extracted through the range-weighted Hough transform.

2. RELATED WORK

2.1 Types of Painting:

Different types of painting are usually identified by the medium that the pigment is suspended or embedded in, which determines the general working characteristics of the paint, such as viscosity, miscibility, solubility, drying time, etc.

➤ Oil painting:

Oil painting is the process of painting with pigments that are bound with a medium of drying oil, such as linseed oil, which was widely used in early modern Europe.

Fig.3.1: Oil Painting

Often the oil was boiled with a resin such as pine resin or even frankincense; these were called 'varnishes' and were prized for their body and gloss. Oil paint eventually became the principal medium used for creating artworks as its advantages became widely known. The transition began with Early Netherland painting in northern Europe, and by the height of the Renaissance oil painting techniques had almost completely replaced temporary paints in the majority of Europe.

➤ Pastel Painting:

Pastel is a painting medium in the form of a stick, consisting of pure powdered pigment and a binder. The pigments used in pastels are the same as those used to produce all colored art media, including oil paints; the binder is of a neutral hue and low saturation. The color effect of pastels is closer to the natural dry pigments than that of any other process. Because the surface of a pastel painting is fragile and easily smudged, its preservation requires protective measures such as framing under glass; it may also be sprayed with a fixative.

Nonetheless, when made with permanent pigments and properly cared for, a pastel painting may endure unchanged for centuries. Pastels are not susceptible, as are paintings made with a fluid medium, to the cracking and discoloration that result from changes in the color, opacity, or dimensions of the medium as it dries.

Fig.3.2: Pastel Painting

➤ Acrylic painting:

Acrylic painting is fast drying painting containing pigment suspension in acrylic polymer remulsion.

Fig.3.3: Acrylic Painting

Depending on how much the paint is diluted (with water) or modified with acrylic gels, media, or pastes, the finished acrylic painting can resemble a watercolor or an oil painting, or have its own unique characteristics not attainable with other media. The main practical difference between most acrylics and oil paints is the inherent drying time. Oils allow for more time to blend colors and apply even glazes over under-paintings. This slow drying aspect of oil can be seen as an advantage for certain techniques, but in other regards it impedes the artist trying to work quickly.

➤ Ink Painting:

Ink paintings are done with a liquid that contains pigments and/or dyes and is used to color a surface to produce an image, text, or design. Ink is used for drawing with a pen,

brush, or quill. Ink can be a complex medium, composed of solvents, pigments, dyes, resins, lubricants, solubilizers, surfactants, particulate matter, fluorescers, and other materials. The components of inks serve many purposes; the ink's carrier, colorants, and other additives control flow and thickness of the ink and its appearance when dry.

Fig.3.4: Ink Painting

➢ Spray painting

Spray painting is a type of painting that comes in a sealed pressurized container and is released in a fine spray mist when depressing a valve button. A form of spraypainting, Spray paint leaves a smooth, evenly coated surface. Standard sized cans are portable, inexpensive and easy to store. Aerosol primer can be applied directly to bare metal and many plastics.

Speed, portability and permanence also make spraypaint a common graffiti medium. In the late 1970s, street graffiti writers' signatures and murals became more elaborate and a unique style developed as a factor of the spraymedium and the speed required for illicit work. Many now recognize graffiti and street art as a unique art form and specifically manufactured spray paints are made for the graffiti artist. A stencil protects a surface, except the specific shape to be painted. Stencils can be purchased as movable letters, ordered as professionally cut logos or hand-cut by artists.

Fig.3.6: Spray Painting

3. PORPOSED MODELLING

Automation or automatic control, is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention, with some processes have been completely automated. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. Complicated systems, modern factories, airplanes and ships typically use all these combined techniques. The benefit of automation include labor savings, savings in electricity costs, savings in material costs, and improvements to quality, accuracy and precision.

The primary aim of the project is to design, develop and implement semiautomatic Wall 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 the 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.

4. RESULTS AND DISCUSSIONS

The construction of Paint Spraying equipment consists of a frame which is used for mounting the components such as D.C motor, Battery, electronic timer unit, solenoid valves, flow control valve and spur gear arrangement. The stand (or) base is to carry the whole machine. The whole experimental setup is shown in. The two conveyor roller is fixed to the two ends of the frame stand with the help of end bearing with bearing cap. The conveyor roller shaft is coupled to the D.C. permanent magnet motor with the help of spur gear mechanism. This total arrangement is used to transfer the material from one place to another place with the help of conveyor.

5. CONCLUSION

Automation is the key concept in every robot, the wall painting robot is designed in such a way that automatically paint the wall of given dimension has been designed and implemented. The approach uses IR transmitter and IR receiver to detect the presence of wall. The microcontroller unit to control the movement of the DC motor. 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, and reduces time consumption. Automatic Painting machine can

also print the huge building easily and safely without any hazards to human being and labors.

REFERENCES

[1] Warszawsky, A., Rosenfeld, Y. "Robot for interior-finishing works in building: feasibility analysis", ASCE Journal of Construction Engineering and Management, 120(1), 132-151, 1994.

[2] Kahane, B., Rosenfeld, Y. "Balancing human-and robot- Integration in Building tasks", Computer-Aided Civil and infrastructure Engineering, 19, 393-410, 2004.

[3] Kahane, B., and Rosenfeld, Y. "Improved tools for robotic interior painting", Proceedings of the 16th ISARC, Madrid, Spain, pp. 275-280, 1999.

[4] Forsberg, J., Aarenstrup, R., Wernersson, A. "A construction Robot for Autonomous Plastering of Walls and Ceilings", Proceedings of the 14th ISARC, June 8-11, 1997, Pittsburgh, PA, USA.

[5] Forsberg, J., Larsson, U., Wernersson, A. "Mobile Robot Navigation using the Range-Weighted Hough Tansform", IEEE Robotics and Automation Magazine, pp. 18-26, March 1995.

[6] Larsson, U., Forsberg, J., Wernersson, A. "Mobile Robot Localization: Integrating Measurements from a Time-of-Flight Laser", IEEE Transaction on industrial Electronics, 43(3), 422-431, 1996.

[7] ABB solutions SpA. "IRB 540, painting robot", available on line at www.abb.com/robots.

[8] Lorenc S.J., Handlon B.E., Bernold L.E. "Development of a robotic bridge maintenance system", Automation in Construction , vol. 9, (251-258), 1999.

[9] Wonnacott, T. H., Wonnacott, R. J. "Introductory statistics", 5th edition, John Wiley and sons, New York, 1990.

[10] Quantitative Mico Software, "Eviews 4 user's Guide", printed by LLC, USA, copyright 1994-2000.

[11] Fu, K. S., Gonzalez, R. C., Lee, C. S. G., "Robotics – Control, Sensing, Vision and Intelligence", McGraw Hill International Editions, New York, 1987.