A Robotic Solution for the Restoration of Fresco Paintings

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Abstract

In this paper, a service robot solution is presented for the analysis, surveying and restoration of fresco paintings. The proposed design approach integrates robot design and restoration operation. It aims to merge them into a feasible solution that can be both practical and feasible for restorers. The simulation results are reported to show a successful design solution, which has been conceived with the constraints of a low-cost user-oriented design and the consideration of cultural heritage.

Keywords Service Robots, Cultural Heritage, Design, Survey, Restoration, Simulation, Prototype

1. Introduction

The problem of restoring damaged and missing areas in artistic works is of great importance in the field of restoration. These restoration problems have similarities in many areas of cultural heritage (architecture, painting and sculpture). Thus, the basic concepts are common but the practice can differ in achieving suitable results that permit the future preservation of a work with a clear indication of passed time. The theory of restoration, as established by Cesare Brandi, [1], requires that the restoration aims to maintain and not renew a historical work. Thus, modern means of restoration must be adapted to damaged historical works and not vice versa. Brandi’s approach can be summarized in three points, [1] as follows:

- An intervention of a restoration must be visible but it must not disturb the whole output of the restored work.
- The appearance and material of a work is irreplaceable.
- A restoration intervention will not prevent future interventions but it will facilitate them.

The disciplines of conservation and restoration of cultural heritage goods are under a significant evolution. Activities and applications from other disciplines and experiences are considered. Collaboration with teams from other scientific and technological areas is useful when looking to reach multidisciplinary approaches. These collaborations produce more successful results both in practical and theoretical terms. In general, restoration activity on a historical good is composed of several phases, with direct and indirect operations that are often completed with chromatic reintegration of lost parts. Colour reintegration can be achieved using several techniques, depending on the
of the printing surface, much more than in the proposed robot solution. Nevertheless, the preliminary prototype of the robot rod frame in Fig. 22 has confirmed the feasibility of the robot design when the successful operation of the inkjet printing is also considered with the properly adjusted carriage motion of the above-mentioned tests.

8. Conclusions

This paper has presented the results of a collaboration between art restorers, survey architects and robotics engineers in order to design a structure and operation of a robotic system for the restoration activity in reintegrating the colour parts in a fresco on the walls of a cathedral. The problems of fresco restoration have been considered with regard to colour reintegration with inkjet printing and using a robotic system both for robotizing the process and facilitating the tasks on the surfaces, which can be inconvenient to human operators. Additionally, the robotic solution has been designed to ensure better precision and repeatability in a well-defined restoration process, which is decided by restorers. The feasibility of the proposed design and its operation have been simulated with reference to a real case of study for a restoration project of frescos in the cathedral of Santos Juanes in Valencia, Spain. Laboratory experiences and a preliminary prototype are presented to discuss the feasibility of the proposed design. Satisfactory results are obtained that give the hope for future implementation and development both of the designed system and multidisciplinary collaboration.

9. References

[9] Regidor Ros J.L.; Palumbo M.; Gomez G.; Clavel I., Restauración y Solución Propuesta Para la Exposi-


