OBJECT TRACKING FRAMEWORK FOR UAV-BASED SURVEILLANCE OF CULTURAL HERITAGE SITES

Pierluigi Carcagnì1, Marco Leo1, Cosimo Distante1, Giovanni Indiveri1,2

1National Research Council of Italy - Institute of Optics Via della Libertà, 3 73010 Arnesano (Lecce) [pierluigi.carcagni,marco.leo,cosimo.distante]@ino.it; 2Dipartimento Ingegneria Innovazione, Università del Salento Via Monteroni, 73100 Lecce [giovanni.indiveri]@unisalento.it

Abstract

Many autonomous vehicles have been developed in last decades. In particular Unmanned Aerial Vehicles (UAVs) have achieved considerable attention in many fields for their great potentials. Diverse UAVs are designed from heavy to miniature in size, and more powerful and agile in capability. They are capable of taking versatile duties, especially when human intervention is boring, hard, dangerous or expensive e.g. hazardous zone or wide range reconnaissance, traffic monitoring, disaster relief support, military operations etc.

This paper proposes an advanced technology framework that, through the use of UAVs, allows to monitor archaeological sites. In particular, a real-time object tracking system is presented and it is applied on video sequences supplied by a quad-rotor UAV equipped with a monocular camera.

The proposed real-time tracking algorithm could be exploited to reconstruct people and vehicle movements and their interactions in order to prevent or immediately detect any action that could damage persons or things (e.g. access to forbidden areas, gathering, loitering, etc.).

While operating, the UAV is hold at a fixed flight position meanwhile the tracking task is performed on the observed scene. The video sequences are sent from UAV, by means wireless link, to a ground station where tracking algorithm is performed. UAV’s attitude is controlled by a FCU (Flight Control Unit) consisting of a CPU and an IMU (Inertial Measurement Unit) with 9 Degrees Of Freedom placed on board the quad-rotor.

Objects to be tracked could be selected manually or by means of advanced detection technique based, for example, on change detection or template matching strategies.

The proposed tracking algorithm has been tested on different image sequences acquired in different sites and under different weather conditions and it has shown good performances even when the object tracked (person or vehicle) moved quickly and irregularly and even if it went in and out of the camera view.

In addition, the experimental sessions have demonstrated that there is no need of any video stabilization to be performed before the tracking task.

As a future work, the proposed tracking procedure will be integrated with computer vision approaches aiming at building panoramic views of the sites (mosaicking) and extracting detailed views (super-resolution), in order to extract more detailed information of the scene dynamics for surveillance tasks.