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DRONE FOR MILITARY APPLICATIONS

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Abstract: The paper introduces a quad-copter-type drone to be used in military applications. The craft is made of carbon fiber and highly resistant plastic and it includes MEMS (Micro-Electro-Mechanical Systems) and a video-processing system that allows a most intuitive control, Wi-Fi and video streaming for the iPad or iPhone interface, as well as software for the processing of the images, which ensures the supplements to the enhanced reality. The quad-copter offers good stability due to the integrated sensors and to the navigation system. Any movement sent over by the pilot will be automatically corrected by the aircraft in order to maintain perfect stability in the air. Due to the pressure sensors, the drone will benefit from automatic stability, irrespective of altitude.
Keywords: drone, sensors, control, motors

1. INTRODUCTION

Pilotless aircraft, also called "drones", represent the most important military innovation of late. If until not long ago, drones were used exclusively in the war zones, they could very soon become present everywhere. From agriculture and archeology to journalism, drones promise to transform numerous domains in the decades to come, marking an unprecedented change in our daily life [1],[2].

The first use of drones in a military conflict was in 1982 in the Lebanon war, when Israeli army sent such pilotless aircraft in order to spy the Syrian defense systems and to collect intelligence needed for their destruction. Later on, drones have become an essential component of military forces. But the military field is not the only one to undergo important transformations as a result of the appearance of drones. These pilotless aircraft are being used in more and more domains[3],[4].

If, at first, drones were being produced exclusively by companies working for the defense bodies, their cost going up to millions of dollars, nowadays there are numerous types, including small and cheap drones that can be controlled by means of a smartphone[4].

2. DESCRIPTION AND PRESENTATION OF THE DRONE

The craft is made of carbon fiber and highly resistant plastic and it includes MEMS (Micro-Electro-Mechanical Systems) and a video-processing system that allows a most intuitive control, Wi-Fi and video streaming for the iPad or iPhone interface, as well as a software for the processing of the images, which ensures the supplements to the enhanced reality, all of which representing a technological world breakthrough. If none of the Apple mobile phones is available, one can use a PC or a notebook operating under Linux and a joystick or a gamepad.

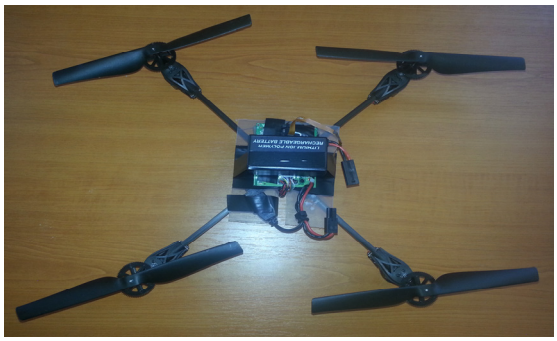

Fig.1. The assembled drone

The resistance structure of the drone consists of an expandable propylene fuselage and carbon fiber tubes weighing 380 g for the outside variant and 420 g for the inside variant. Upon the

resistance structure there are also the ultrasound sensors, which are covered by a protection layer, against liquids [5].

The drone also includes four brushless internal motors (Fig.2) with a consumption of 14,5 watts and 28 500 rpm in flight[10].

Fig.2. Brushless motor

Fig.3. Mainoboard

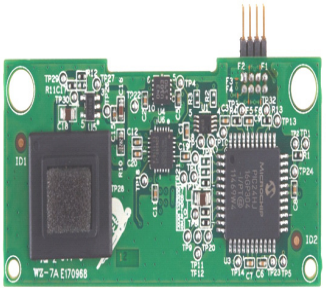

Fig.4. The navigation board

Fig.5. Ultrasound sensor

The electronic assistance is ensured by a mainboard (Fig.3), including a Wi-Fi Atheros chip and a USB Port for communication with a PC or for eventual extensions. The mainboard contains a central ARM Cortex A8 processor whose frequency is 1GHz A8, with 8GHz video DSP and 1 Gb of RAM memory, working at a frequency of 200 MHz.

The navigation board (Fig.4) contains sensors and a MIPS 40 microcontroller with a 12-bit ADC convertor. It includes an ultrasound transceiver (Fig.5) meant to measure the distance between the drone and the earth, up to 6 meters [5]. The motor cross (Fig.6) is made of PA66 (high quality plastic), with four carbon fiber tubes and the motor attaching devices [6]. An arrow indicates the way the cross is to be assembled. Two wire sets: one to feed the motors and the other one is a 5 V supplement meant to control each motor separately [7],[8].

Fig.5 The main axis- the motor cross

Fig. 6. Drone control by means of a smartphone

3. DRONE CONTROL

The control of the drone is done by means of the mobile phone accelerometer, not by Bluetooth connection but by WiFi, the drone generating its own network. The drone is easy to use and the commands can be learned very quickly. Taking off and landing are being operated by the Autopilot function, which stabilizes the quad-copter at 50 cm after take off and also before a smooth landing. The autopilot also intervenes when a phone call is received, stabilizing the craft at a fixed point and, if the call is answered, the autopilot automatically lands the drone after a certain period of time. The autopilot also comes in when the WiFi connection is lost. The device allows limit setting of flight speed in all directions, ascending speed and many other flight parameters [9],[10]. The drone was designed to work both indoors and outdoors. In case of impact, the propellers stop automatically and the craft enters free falling. Flight autonomy is about 12 minutes, and batteries can be recharged in 90 minutes al most.

4. CONCLUSIONS

Steering a military drone becomes a unique experience, due to the well determined control by smartphone or tablet, which can also visualize and record the high quality images from the auxiliary camera. The drone can explore up to an altitude of 50 m. The pressure sensors located on the navigation board offer a unique stability, which will automatically correct and maintain the position in the 3D space, irrespective of altitude and wind (up to 15 km/hour).

The image obtained by the high definition camera is similar to the one a real pilot sees. The image is streamed in real time, thanks to the automatically generated WiFi network. The automatic stabilization system of the drone will ensure a clear image, both inside and outside and even when there is a slight wind.

The quad-copter offers a unique stability due to its integrated sensors and to its navigation system. Any movement commanded by the pilot will be automatically corrected by the aircraft, in order to maintain an excellent stability in the air. Due to the pressure sensors, the drone will benefit from automatic stability, irrespective of the altitude.

The device is endowed with a HD camera, a video recording device and, besides the flight data exchange, it ca also stream real time images. The camera has lenses of 720p resolution (30 frames/s), and it can also recognize specific shapes and colors, in order to pinpoint the enhanced reality elements on the screen.

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