

AN INVESTIGATION OF USING LIFE DETECTION QUADCOPTERS IN EARTHQUAKES: THE CASE STUDY OF IRAN

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Keywords: Life detector, Ultra-wideband, Earthquake, Crisis management, Quadcopter

Earthquakes are unfortunately frequent happenings and very dangerous natural phenomena in each country and Iran is no exception. Due to specific geological condition of Iran, this country experiences considerable numbers of earthquakes every year which one or two of them at least are between 6 and 7 Richter's magnitude scale and in each decade 1 or 2 earthquake occur with greater than 7 Richter's magnitude scale (Hashemi & Sarabi, 1390). In this condition, it is obvious that in almost every major earthquake many victims are buried under collapsed buildings, bridges, roadways, etc. It is very difficult to rescue these people, who may well be injured, hungry and weak. In addition, the structural conditions under the rubble can be complex, dangerous and unknown. Therefore, there is a primary need to explore these situations and identify the victim's location and their condition. For this reason, novel methods needed be applied to minimize costs and enhance rescue purposes. Methods such as life detection dogs, noise detection, thermal sensor and bio-radar life detector are available today, however, each of them has specific drawbacks which are discussed in this research and for overcoming these drawbacks, this paper is focused on a life detection drones for identifying breathing frequencies as well as heart beat with UWB radar (ultra-wideband radars) which this approach has not the problems of available methods, even though, these drones have not produced in large scale yet. The drone which is the subject of discussion in this research is from multirotor family and is a type of quadcopter. Quadcopter, also known as quadrotor, is a helicopter with four rotors. The rotors are directed upwards and they are placed in a square formation with equal distance from the center of mass of the quadcopter. The quadcopter is controlled by adjusting the angular velocities of the rotors which are spun by electric motors. Quadcopter is a typical design for small unmanned aerial vehicles (UAV) because of the simple structure. Quadcopters are used in surveillance, search and rescue, construction inspections and several other applications. The possible field of applications for an autonomous drone may reach from emergency tool for firefighters and disaster controllers over observation and exploration for both known and unknown areas to many further domains (Nageli et al., 2016) wherever a flying machine can help humans in their daily work. Figure 1 demonstrates the simple design of a quadcopter.

Furthermore, in this research we investigated the benefits of a quadcopter for rescuing victims of an earthquake and also its drawbacks are studied as well. At the end, we suggested to add a UWB radar detector in the quadcopter for maximizing the effectiveness of these life detector drones and also the advantages and disadvantages of adding this radar to the life detector quadcopter. It should be mentioned that, UWB radar is for detection and positioning of human beings in complex environment has been developed and manufactured. Ultra-wideband radars are used nowadays for different applications such as subsurface sensing, classification of aircrafts, collision avoidance, etc. In all of these applications the ultra-high resolution of UWB radars is essentially used. One of these applications is detection of humans trapped in buildings on fire, in collapsed buildings. Finally, according to all researches and investigations, utilizing life detector quadcopter with UWB radars is vital for Iran's earthquakes due to the high possibility of earthquake in this country and the effectiveness of using this approach in rescuing earthquake victims.

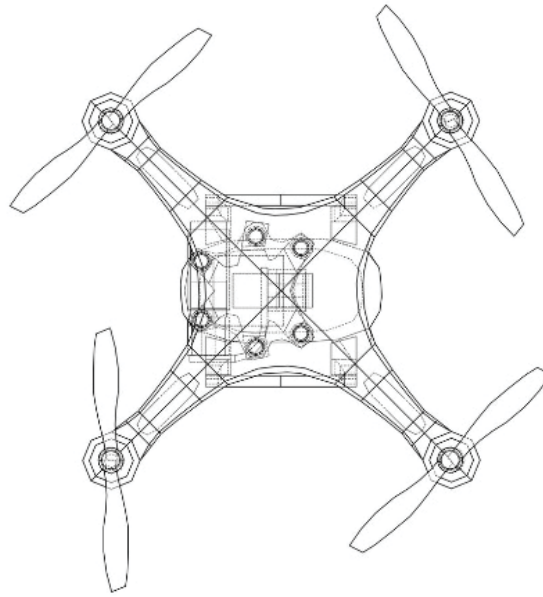


Figure 1. A simple design of quadcopter (Luukkonen, 2011).

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