802.11 Network Planning based on ESBEA Evolutionary Algorithm to Improve Location Accuracy

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ABSTRACT

During the last decade, the human or mobile terminal positioning becomes more and more, a key software-market development pillar. The growing use of multi-positioning systems is contributing to improve the coverage and the accuracy of the positioning services. When combined with the diversity of new actuators and smart sensors on hand held devices, cooperative and multi-positioning systems are yet perfectible and expensive.

We propose to combine real-time image analyses embedded on smart mobile devices to improve the availability and the accuracy of positioning services in dash environments (indoors and outdoors environments). We have leaded a study on several cameras as those available on AR-Drone, Samsung Galaxy Tab, and Androïd smartphones to measure the impact of brightness, the distance and the angles (tilt and azimuth) from cameras to markers, the positioning accuracy, the fluidity of calculus and the number of markers being processed simultaneously. A first test scenario, conducted inside a blind room being enlighten with conventional lights, show a positioning error varying from 0 to 0,1 % when the distance and the angle does not exceed 7 metres and 150° respectively. Two others experiments were conducted. The first one, by monitoring an AR-Drone with 2 cameras (front and down), a GNSS actuator, and a disseminated Wi-Fi infrastructure positioning system, we have demonstrated the feasibility and the pertinence combining multi-positioning systems (GNSS, Wi-Fi and image marker analysis) to better match a 2D marker database, and provide an improved accuracy from 8 meter outside (GNSS) and 4 meter inside (Wi-Fi) to millimetre precise positioning. Hence, the underlying algorithm is presented. It is a millimetre precise positioning for smart mobile devices in dash environments. It is based on Image Marker Analysis (IMA) on the fly and it refines Wi-Fi and GNSS based positioning in scenarized dash environments. The second and last experiment conducted has adapted the IMA-based positioning algorithm with 2D key points' natural markers to better position a Galaxy Tab smartphone and apply a virtual 3D animation above a real picture of a roman amphitheatre. This experiment has demonstrated our approach based on 2D QR-TAG or natural marker analysis allows an accurate positioning and insert a stable 3D-animation within smartphone augmented reality applications.

KEYWORDS: indoor positioning, positioning algorithm, QR-TAG, natural marker, multi-positioning system, image analysis.