Better virtual objects placement in real world through photogrammetry for object recognition and spatial anchoring

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ABSTRACT

Augmented reality is one of the technologies, which in recent years has been most in the spotlight for communities as diverse as researchers, industrial actors and gamers. A common need in almost any scenarios is to “register” the virtual world with the real one, so that the right virtual objects can be accurately placed in the user's view. Although positioning could be aided by global systems such as GPS, there are situations in which its accuracy or feasibility cannot be guaranteed. Indeed, a few sectors could be prevented from exploring augmented reality as a disrupting technology if this need cannot be adequately fulfilled. In this work, photogrammetry is investigated for scenarios in which a few static already known and well-defined real-world objects can be used for anchoring in a broader area. The goal is to create a solid and reliable augmented reality framework in terms of precise placement of objects with the aim of using it in contexts where other solutions lack the required accuracy. In particular, this work considers as the primary use case a solution developed using Microsoft Hololens 2 for the positioning of digital objects in the context of railway maintenance by exploiting the recognition of real objects in the environment through photogrammetry techniques. Indeed, only a precise positioning of the objects will allow the pervasive diffusion of this technology in sectors such as health, military and in any case in all those contexts where accuracy and reliability are essential elements for ensuring safety of operations.

Keywords: Augmented Reality, Photogrammetry, Anchoring

1. INTRODUCTION

A common need in almost any augmented reality (AR) scenarios is to “register” the virtual world with the real one, so that the right virtual objects can be accurately placed in the user's view. Although GPS could aid the positioning of virtual objects, there are situations in which its accuracy or feasibility cannot be guaranteed.

We employ photogrammetry to create a solid landmark in an AR scenario to identify other small components, such as defects or objects. To realize this goal, we develop a solution using Microsoft Hololens 2 to position digital objects in a closed environment and on the railway track.

With the help of holographic lenses, the user recognizes this anchor and then identifies the proper placement of detects on which to perform maintenance. In addition, helpful information concerning the kind of defect or the instruments employed to perform maintenance could appear in an AR panel.

The process is summarized as follows. The first step consists of realizing a 3D scan of the real object, which must be used as an anchor point. A 3D model is built successfully, starting from the 3D image, and placed into an AR scenario. The application is then exported on the Hololens 2. When the user, wearing the holographic device, recognizes the real scene's landmark, a marker appears at a predetermined distance. We applied this method to identify the accurate position of a defective component on the railway track. To this end, we use a buffer stop placed at the end of a railway track as the anchor. The exact process has been applied in our institute laboratory, using a robot as a landmark.

The rest of this paper is organized as follows. In Section 2, we straightforwardly describe the methods; In Section 3 we present our result, and in Section 4 we mention our conclusions and future work.

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2. METHOD

The proposed method consists of six consecutive steps. First, we chose a real object, a robot placed in the laboratory, as an anchor, and we scanned it using several free applications installed on a mobile device. Using the camera of an ordinary smartphone, we made about 60 pictures of the real object and exported the 3D image (Figure 1).

Figure 1. The 3D image was obtained by scanning the actual object with the camera of a mobile device

Second, we convert this 3D image into a model target using the Vuforia Engine Model Target Generator1 and conveniently set the parameters. Successively, we put the model target into an AR scene created by Unity[2] . In this scene, we add a marker (Figure 2.), for example, a green check mark, appearing in the real scene when the user recognizes the robot. Finally, we export this application created by Unity on the Hololens 2[3].

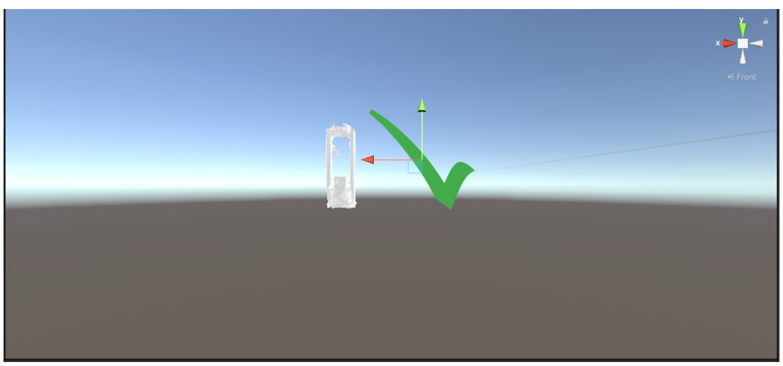

Figure 2. The Unity scene with the model target and the marker.

3. RESULTS

The user wears the holographic device and launches the applications described before. After that, the user scans the area: when the Hololens 2 recognizes the real object chosen as an anchor, a marker appears in the place established in the Unity scene (Figure 3. And Figure 4.).

Figure 3. The user recognizes the robot placed in the laboratory, and a green mark check appears

Figure 4. The user recognizes the buffer stop at the end of a railroad

4. CONCLUSIONS AND FUTURE WORKS

Realizing an accurate positioning of objects in a broad area is fundamental in the industrial and transportation field. Here we present a method to recognize a real thing and place it in an AR scenario. Possible applications range from the industrial to the transportation field.

Possible future studies include placing blood cells in a virtual reality scenario to evaluate their characteristic properties and movement in blood vessels.

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