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Remote Creation and Editing of Augmented Reality Content Using Cloud Anchors

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ABSTRACT

Adding augmented reality content, such as virtual objects, at a physical location currently requires the creator to be present at the location to capture a video of the scene and to add AR content. This disclosure describes the use of cloud anchors that enable a user to record a video at a location along with AR metadata such that AR content can be added to the location (or modified) at a later time when the user is at a different location. The cloud anchor can also be used for real time or offline with other users who are not at the location where the AR content is captured.

KEYWORDS

- Augmented reality (AR)
- Mixed reality
- Collaborative AR
- AR annotation
- Indoor navigation
- Cloud anchor
- Remote collaboration

BACKGROUND

Augmented reality (AR) is an interactive experience of a real-world environment where the real world is enhanced by adding computer-generated objects and information. Augmented reality is used to enhance natural environments or situations and offer perceptually enriched experiences. Cloud anchors are a popular mechanism to enable persistent AR experience, in which one person can place an AR object in the physical environment (anchored to the

environment, and stored in the cloud), and another person can see the same AR object at the same place at a later time (by having their AR app retrieve the cloud anchor).

Persistent cloud anchors enable use cases like leaving AR notes for guests, designing a home with AR over time (with AR offering views of the home at different points in time), or playing world scale multiplayer AR games (e.g., in which users or game developers leave virtual objects for others to find). Persistent cloud anchors can be created by a user that is at a physical location (e.g., a home) by using their smartphone (or other AR camera) to capture the live scene and augmenting the place by adding virtual objects at specific places (e.g., a kitchen countertop) within the captured physical location.

Persistent cloud anchors solve the problem of time, where adding an AR object to a physical location and discovering the object at the physical location can be done at different times. However, cloud anchors do not currently address the challenge of space - a user cannot add (or edit) an object to a physical location that they are not present at, nor can they discover an object at a remote location.

This restriction places a limitation on certain use cases. For instance, for a host to leave an AR note in the kitchen or living room for their guests, the host needs to be physically present in the space. Due to the space limitation, it is not possible to leave AR notes when the host is not physically present in the home.

DESCRIPTION

This disclosure describes techniques that utilize augmented reality (AR) post-capture technology to enable users to add or modify cloud anchors for augmented reality at a location without being at the location, thus addressing the space constraint described above. A user can record a video of a physical environment using an AR application and associated software

development kit (SDK). The recorded video includes AR metadata that is sufficient for insertion or update of AR objects at the location at a later time.

Recording and playback is provided via the SDK that enables a user to add new cloud anchors (to insert an AR object) or modify previously stored cloud anchors (to modify a previously placed AR object or its location) by editing the pre-recorded videos. By using the captured raw image and sensor data, AR metadata of the scene (e.g., AR planes, camera pose etc.) is obtained and stored in association with the cloud anchor. The stored images and AR metadata enables a user to view the scene while at a different location and to modify the AR content. Fig 1 illustrates an example architecture that can be used for this purpose.

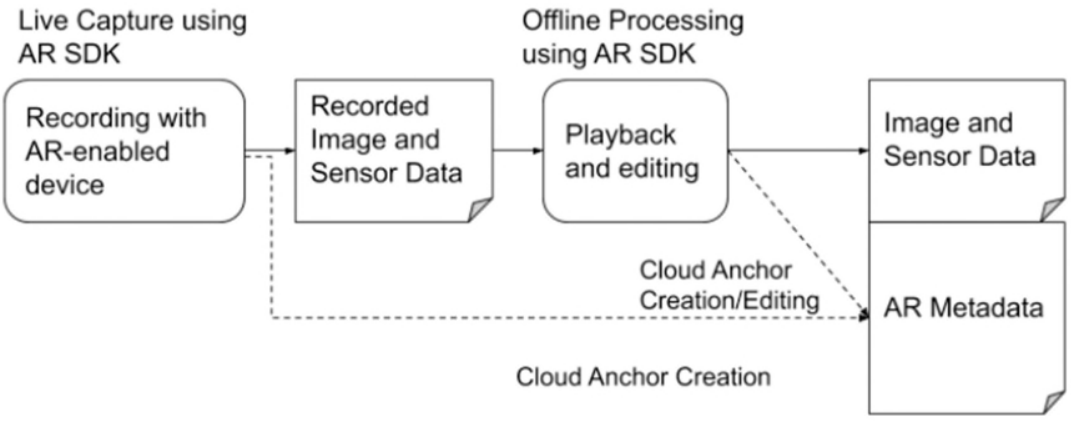

Fig. 1: Example architecture for cloud anchor creation and editing

Per the architecture of Fig. 1, at an initial time, when a user is at a physical location, the user records a video using an AR-enabled device using the AR SDK. The user can add an AR object while engaged in the live capture. The image and sensor data and AR metadata are stored in a cloud anchor, and are made available for offline viewing and editing to the same users and/or other users with whom the cloud anchor is shared.

The same user or another user can then initiate a playback of the recording and edit the AR content associated with the location while viewing the recording. The updated content is stored in the cloud anchor.

Some example use cases that are served by editing AR content while at a different location include:

1. A user can create a new cloud anchor (e.g., by adding AR content to a location by editing a previously captured scene) or edit the existing cloud anchor (e.g., by updating the AR content based on a recorded scene) remotely from a different physical location.
2. Multiple users can collaborate remotely in the same AR environment using the cloud anchor. For example, if two individuals are shopping for furniture, one person may be at the physical location and use a live camera, while another person can collaborate remotely using the content from the first person.
3. The techniques can be used for indoor navigation and AR annotations while not physically present at a location, e.g., a shopping mall. A creator can record a video, and the same or another individual can create and edit AR annotations at a later time/place by initiating video playback and updating the AR content. For example, shopping malls or local businesses can add AR signage, AR coupons, etc. in this manner.

Offline creation and/or editing of cloud anchors based on pre-recorded content can be used in various augmented reality applications. For example, users that generate or view AR content using augmented reality glasses can engage in remote collaboration using the techniques described herein. Many applications can use the described techniques to enable users to remotely add AR notes or annotations at a location. For example, applications such as photo sharing via AR (where users create and leave AR notes for each other) or content discovery via camera can

utilize the described techniques. Video sharing platforms can provide videos with AR metadata and enable users to add/modify AR content. Indoor navigation using AR can be improved by using the described playback techniques to update navigation annotations.

CONCLUSION

Adding augmented reality content, such as virtual objects, at a physical location currently requires the creator to be present at the location to capture a video of the scene and to add AR content. This disclosure describes the use of cloud anchors that enable a user to record a video at a location along with AR metadata such that AR content can be added to the location (or modified) at a later time when the user is at a different location. The cloud anchor can also be used for real time or offline with other users who are not at the location where the AR content is captured.

REFERENCES

1. Cloud Anchors overview for Android, available online at https://developers.google.com/ar/develop/java/cloud-anchors/overview-android accessed 17 November 2020.