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Controlling the density of user-generated content in augmented reality

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ABSTRACT

In a multi-user augmented reality (AR) environment, a user can insert virtual objects that other users can see. If users place objects without constraint, then the AR view can become dense, overwhelming, and hard to understand. Per the techniques of this disclosure, the density of objects in an AR environment is constrained by maintaining a minimum distance between existing and newly-placed objects.

KEYWORDS

- Augmented reality
- User-generated content (UGC)
- Multi-user AR
- Object density
- Persistent UGC

BACKGROUND

In a multi-user augmented reality (AR) environment, a user can insert virtual objects that other users can see and examine. Multi-user AR finds application in domains such as multi-player AR games, engineering design, healthcare, etc. In multi-user AR, if users place objects without constraint, the AR view can become visually cluttered, overwhelming, and hard to understand.

A grid can be used to constrain object placement, as is done in certain video games. However, grids create limited content placement options that do not conform well to real-world environments. The physics used to govern virtual objects in augmented reality can prevent three-dimensional objects from going through or overlapping with one another. However, while physics prevents literal overlap, it does not control overall content density. Also, physics may be inapplicable to certain classes of virtual objects.

DESCRIPTION

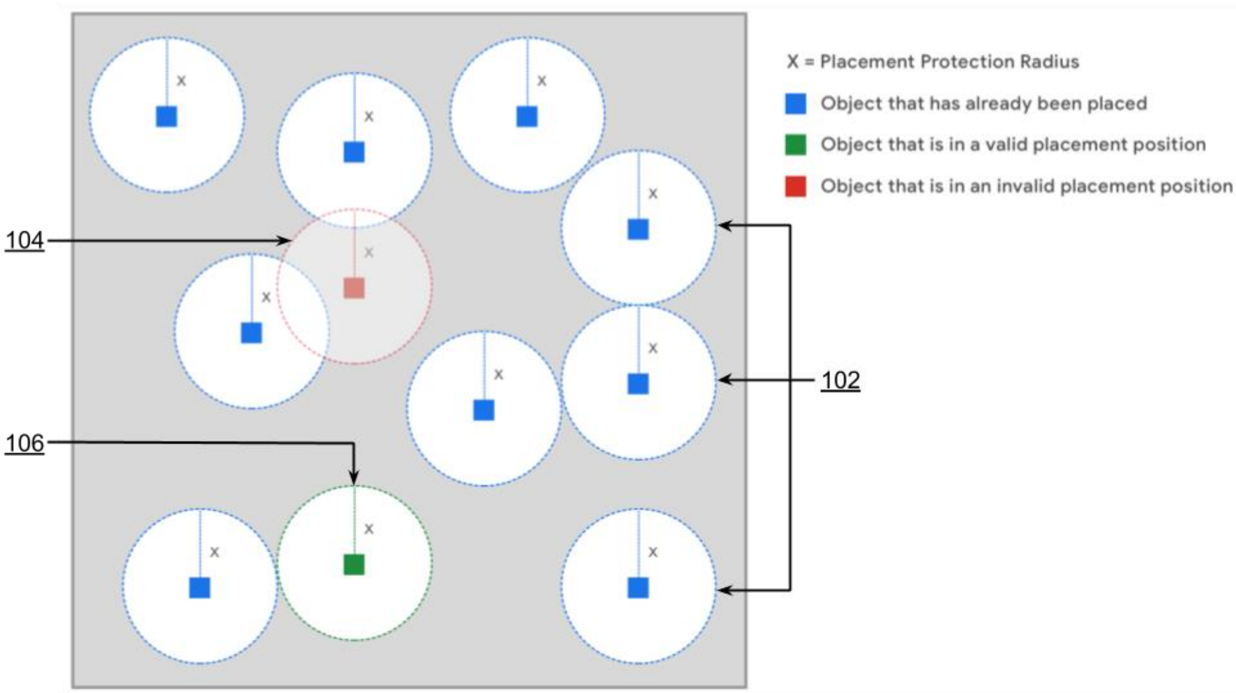

Fig. 1: Controlling the density of virtual objects by maintaining a minimum distance

Fig. 1 illustrates controlling the density of persistent user-generated content (UGC) in an AR field, per techniques of this disclosure. A sphere of radius *x* (placement protection radius) is established around existing objects (102), shown in blue. The existing objects can be real objects or virtual objects. Placement of new objects, e.g., user-generated objects, is subject to the constraint that the spheres of existing and new objects do not intersect. For example, the newly added red object (104) has invalid placement because its sphere intersects with the spheres of existing objects. The newly added green object (106) has valid placement because its sphere does not intersect with any sphere of existing objects. In this manner, a natural limit is created on the total amount of content in a given physical space, while enabling users to pin content in an otherwise unconstrained manner.

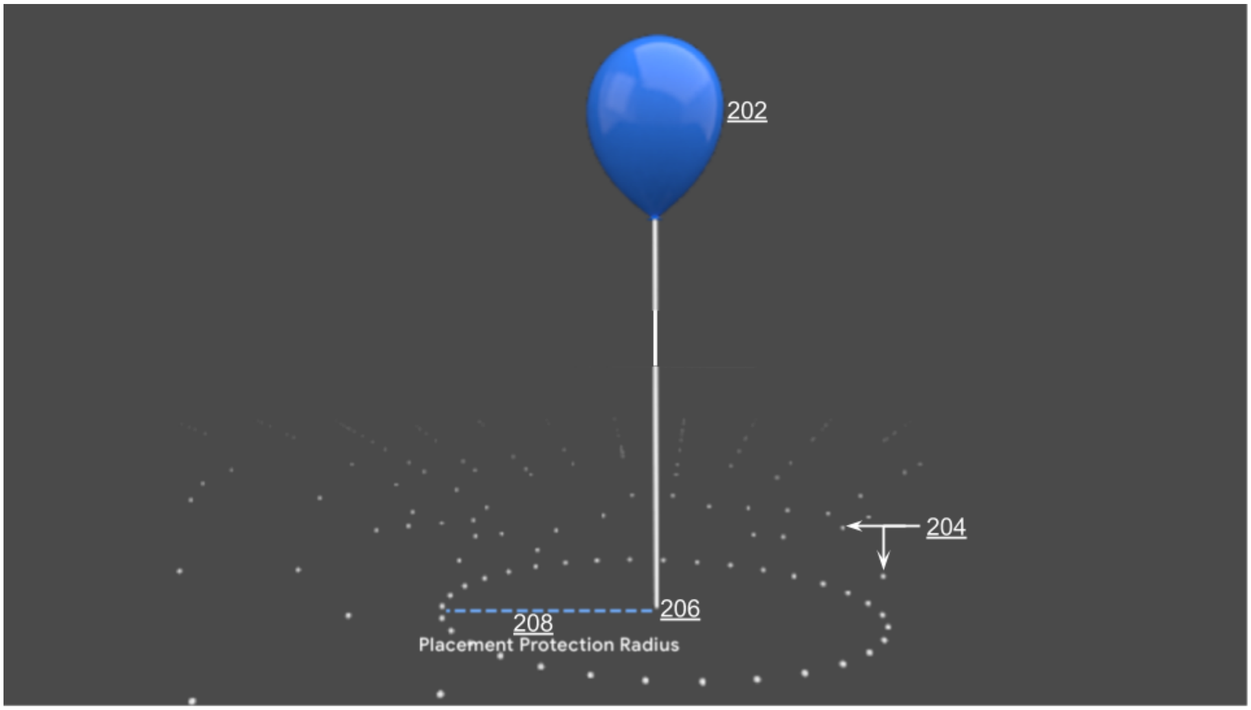

Fig. 2: A virtual object is placed while maintaining minimum distance from other objects

Fig. 2 illustrates the placement of a virtual object while maintaining minimum distance from other objects in a shared field of view. Potential object positions are represented by white dots (204). When a new virtual object (202) is placed at a location (206), no other objects can be placed within its placement protection radius (208).

UGC density in AR is controlled by a single parameter, the placement protection radius. The placement protection radius can be set by the AR developer or administrator. The density of AR content is tuned to be appropriate to the scale of the underlying physical space. For example, the density of content appropriate to an AR experience in a football stadium is different from the density of content appropriate to an AR experience in a small room. The scale of the underlying physical space is determined based on real images, obtained and analyzed with user permission.

CONCLUSION

Per the techniques of this disclosure, the density of objects in an AR environment is constrained by maintaining a minimum distance between existing and newly-placed objects. A clear, relatively clutter-free field of view is thus provided where user-generated content does not unduly obstruct other content or become overwhelmingly dense.

REFERENCES

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