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December 2019

AUTOMATIC GENERATION OF 3D CAMOUFLAGE AND OTHER PATTERNS

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Recommended Citation

INC, HP, "AUTOMATIC GENERATION OF 3D CAMOUFLAGE AND OTHER PATTERNS", Technical Disclosure Commons, (December 23, 2019)

https://www.tdcommons.org/dpubs_series/2812



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Automatic Generation of 3D Camouflage and Other Patterns

This disclosure relates to the field of 3D printing. We use the colors, patterns, and textures of a terrain to generate 3D surfaces and objects that are camouflaged in that environment. We can automatically scan the visual information using cameras, depth cameras, and other visual sensors, or we can work from photos, videos, or even descriptions. We then generate a 3D model of a surface from this visual information. This means that a 3D printer deployed in a region can generate on-the-fly objects camouflaged for that region.

Description

There are groups of people who don't want themselves or their equipment to be seen, including military and medical units in hostile environments, scientists trying not to be noticed by wildlife, and so forth.

Using, for example, 3D printing capabilities, we can print surfaces of color and texture for camouflage purposes. We can obtain the input for the printable camouflage CAD (computer aided design) models automatically using photographs or other sensing or descriptions.

As an example:

A military unit is deployed to a forest area in the summer. They already have a 3D printer with them to their forward operating base for printing spare parts as needed. They take some photos and depth imagery of the surrounding terrain. From these images they automatically generate a 3D texture that

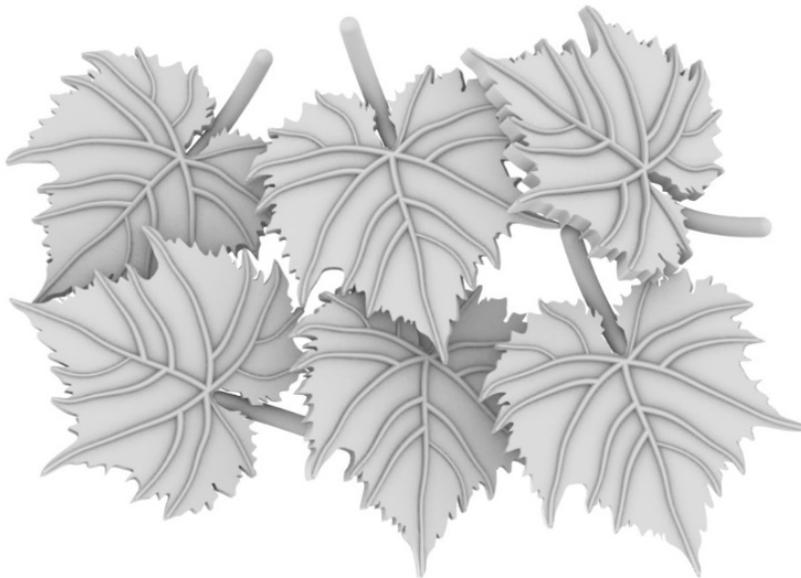


Figure 1: example 3D texture for camouflage surface.

combines the colors and shapes of the terrain. Raised areas of the texture are generated by detecting surfaces from the image data and extruding them by parameterizable, flexible amounts. They can then print new copies of buckles, helmets, equipment covers, and so forth using this camouflage.

As summer turns to autumn, the colors and patterns of the forest change. Using new imagery, equipment can be updated to blend in with the changed environment. See Figures 1 and 2 for an example texture and

colors.

Likewise, urban areas can change dramatically as a result of natural disaster or warfare. Even urban camouflage may need to be updated on short notice.

Extensions

This concept could be generalized to 3D printing non-camouflage textures from photographs. It can also be combined with a system that prints to textiles for clothing that combines textile and 3D printed elements.



Figure 2: example colors for 3D printed surface. These colors might be different in the summer versus the autumn.

Previous solutions

2D (fabric) camouflage is ancient but continues to be used because it is effective. However, it is not always practical to cover everything with fabric. Examples include buckles on backpacks, holsters for weapons, helmets, tripods, and the covers of much larger objects.

It is possible to paint 3D objects with a camouflage pattern, but this requires more intervention than automatically sensing the necessary camo patterns and generating it on the fly.

In addition, using 3D print we can customize not just the colors and pattern, but also the texture. We can create textures that are highly unreflective, or that resemble foliage, sand, pebbles, water ripples, and other natural elements. Likewise, for urban camouflage we can generate textures that resemble asphalt, concrete, etc.

There exist current solutions for scanning 3D objects, including sample textures, and creating 3D models from them for further printing. These solutions do not currently extend to capturing the environment itself.

Disclosed by Mary Baker, HP Inc.