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Invited

Plant and Animal Display

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ABSTRACT

In our laboratory, we are developing the system to automatically generate a projection mapping onto natural objects such as leaves and flowers, for which it is currently difficult to apply tracking markers. Our projection mapping allows user interactions such as contact and covering. We describe our results with some animated effects on various moving leaves and flowers. Also we would like to talk about anything related to the topics.

1 INTRODUCTION

Recently, the targets of projection mapping (PM) have included objects ranging from buildings to fish. However, it is difficult to project onto dynamic and deformable natural objects such as leaves. Some fantastic artwork related to the PM of plants was created using the motif of bioluminescence [1]. However, the mapping required a considerable length of time to register the projection images manually for the plants in a forest. Various automatic high-speed registration methods have been proposed [2,3]. However, it is difficult to automatically register images for dynamic and deformable targets at high speed without inputting a 3D model or attaching markers in advance. As leaves have various shapes, a method that automatically registers images for dynamic and deformable targets without such preparations has been developed [4]. However, this method can only be applied to limited target shapes such as ginkgo and maple leaves because of its assumption that the distance between the longest contour points is the long side of a leaf. Our system achieves more flexible and robust performance by applying tracking at two scales using the Laplacian.

2 SYSTEM OVERVIEW

Here, we describe our basic system overview. We proposed some method to track objects however these methods are based on the system such as the below.

Layout of devices:

Our proposed system, comprises an infrared (IR) camera, an IR light, and a projector. The projector–camera system consisted of a camera and projector packed as closely together as possible.

Camera and projector registration:

In the pre-processing stage, we record the sizes of the images projected by the camera, and fit the images to the whole projection area [4].

Tracking:

In the first frame (*t=0*), the projection areas are specified by the user from among the regions via contour extraction from the image I^t obtained by the camera. The contour vertex of each area is $\boldsymbol{p}_{ij}^t$ for *i=1,2,…, l,* where *l* is the number of projection areas by texture mapping, and *j=0,1,2,…, m,* where *m* is the number of vertices in an area. The animated effects are then generated from the acquired contours. After *t=0*, the system finds position $\boldsymbol{p}_{ij}^t$, which is the result of tracking $\boldsymbol{p}_{ij}^{t-1}$ (Figure 2). The effects are deformed to the tracked projection area by texture mapping using $\boldsymbol{p}_{ij}^t$. The process applied to every frame.

2 RESULTS

Figure 1-6 shows the animation effects track the moving leaves, flowers, and silkworm.

Fig. 1 Our projection mapping results: oval leaf.

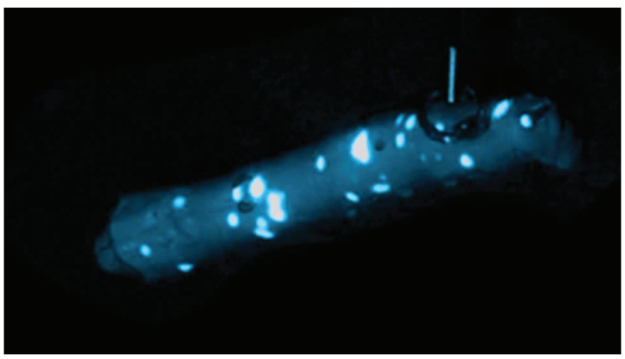

Fig. 2 Our projection mapping results: silk worm.

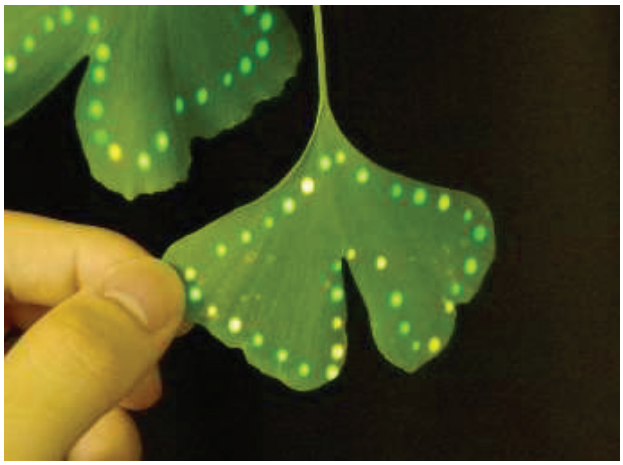

Fig. 3 Our projection mapping results: ginkgo.

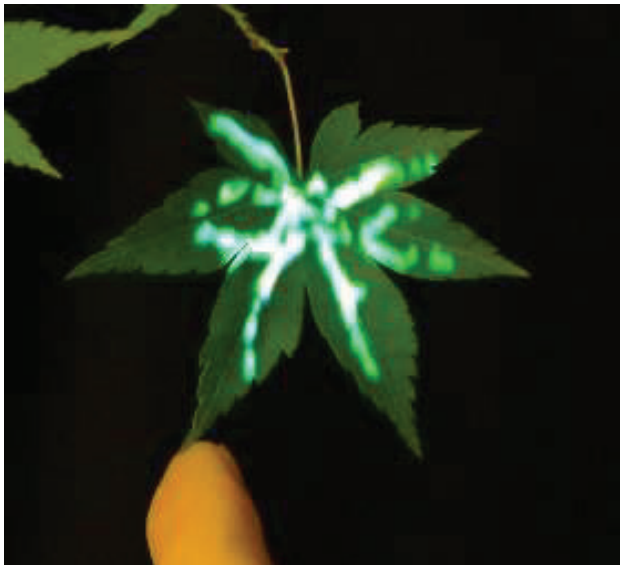

Fig. 4 Our projection mapping results: maple leaf.

Fig. 5 Our projection mapping results: ivy leaf.

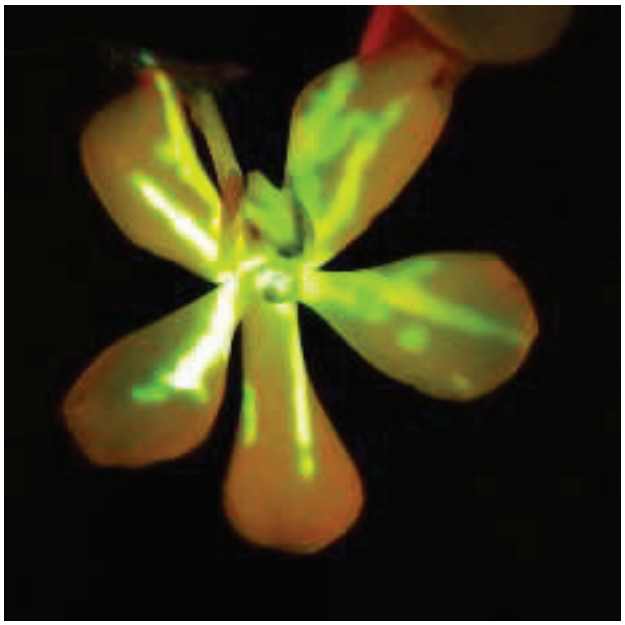

Fig. 6 Our projection mapping results: flower.

3 CONCLUSIONS

We have proposed the automatic generation of tangible PM on deformable objects with various shapes without any markers. One limitation of our current system is its sensitivity to the lighting environment. In future work, we would like improve our method to consider targets besides leaves and flowers. This work was supported by JSPS KAKENHI Grant Number 18K11956.

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