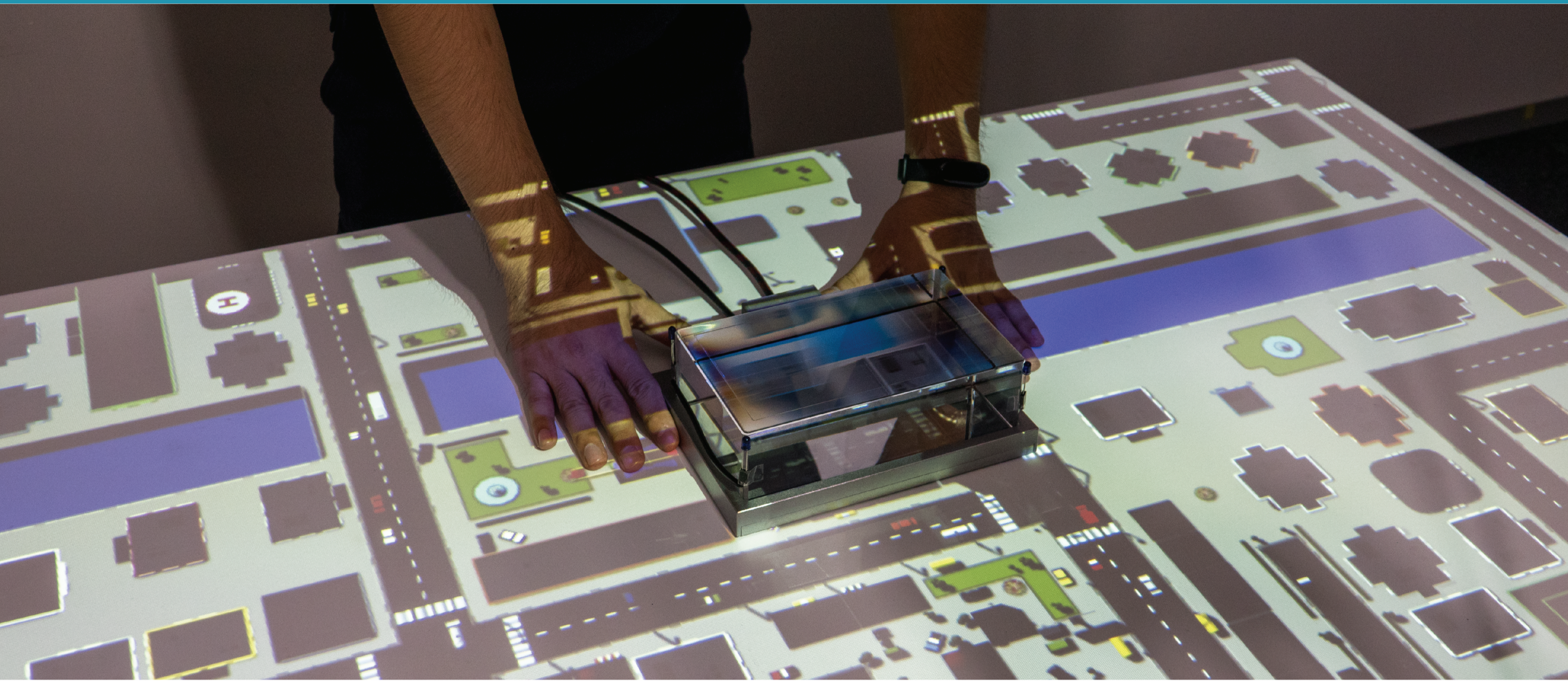


Pop-up digital tabletop: seamless integration of 2D and 3D visualizations in a tabletop environment

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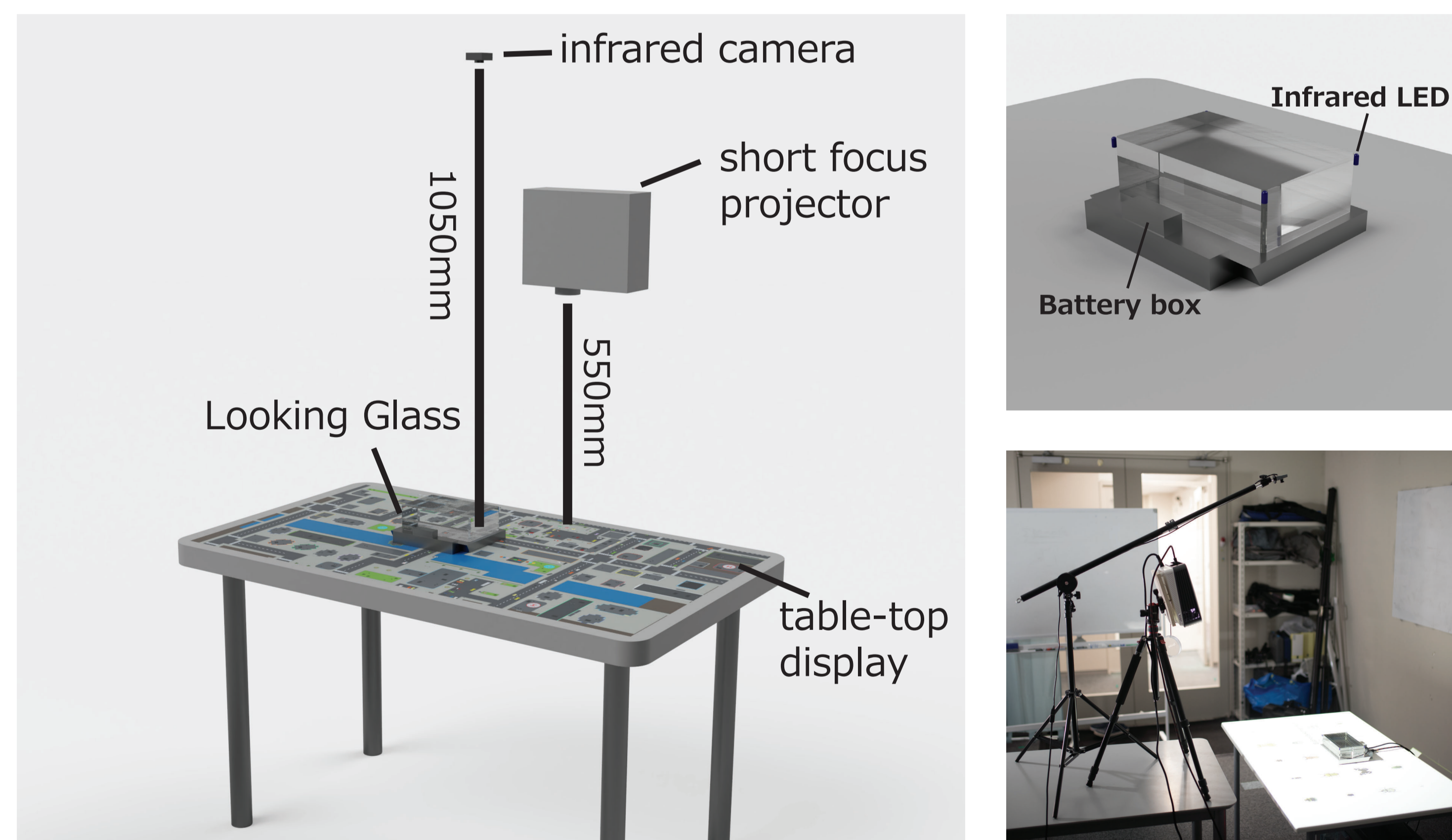
Abstract

Goal: View 3D content efficiently and easily
Approach: Combine a digital tabletop display and light-field display

We propose a pop-up digital tabletop system that seamlessly integrates two-dimensional (2D) and three-dimensional (3D) representations of contents in a digital tabletop environment. By combining a digital tabletop display of 2D contents with a light-field display, we can visualize a part of the 2D contents in 3D. Users of our system can overview the contents in their 2D representation, then observe a detail of the contents in the 3D visualization. The feasibility of our system is demonstrated on two applications, one for viewing insect specimens, the other for browsing cityscapes.

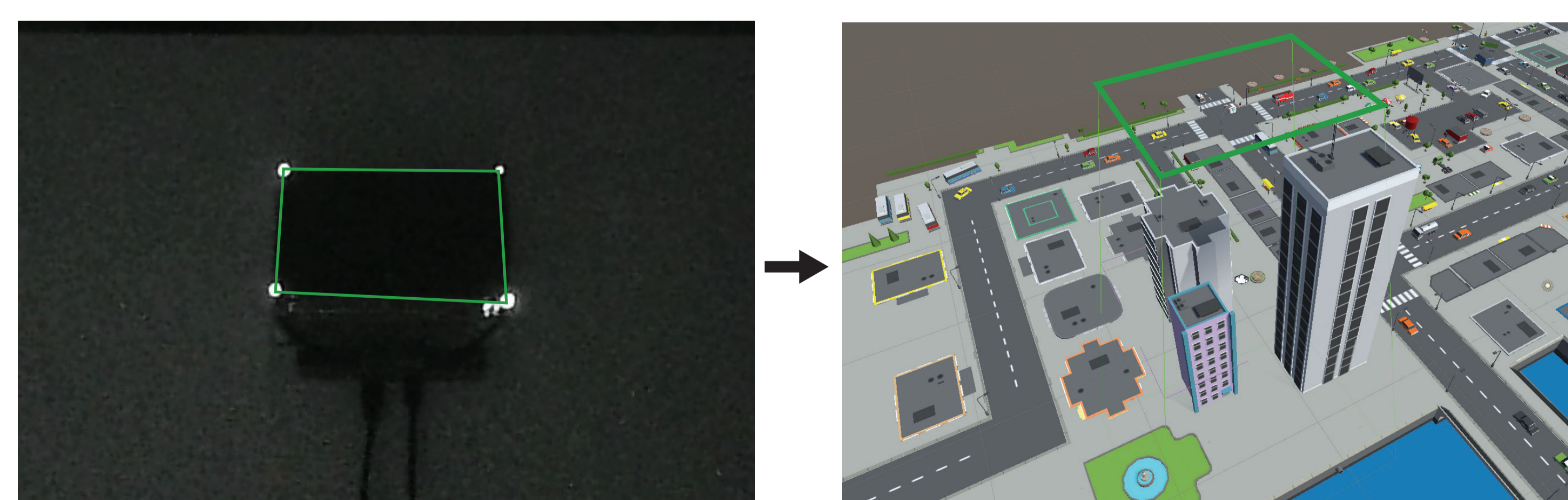
Our system

We use The Looking Glass^[1], which provides 45 unique images over a horizontal range of 50. The Looking Glass is placed face up on the table, and users slide it on the table.



Tracking and Synchronization

We track the light-field display by using infrared LEDs and camera.

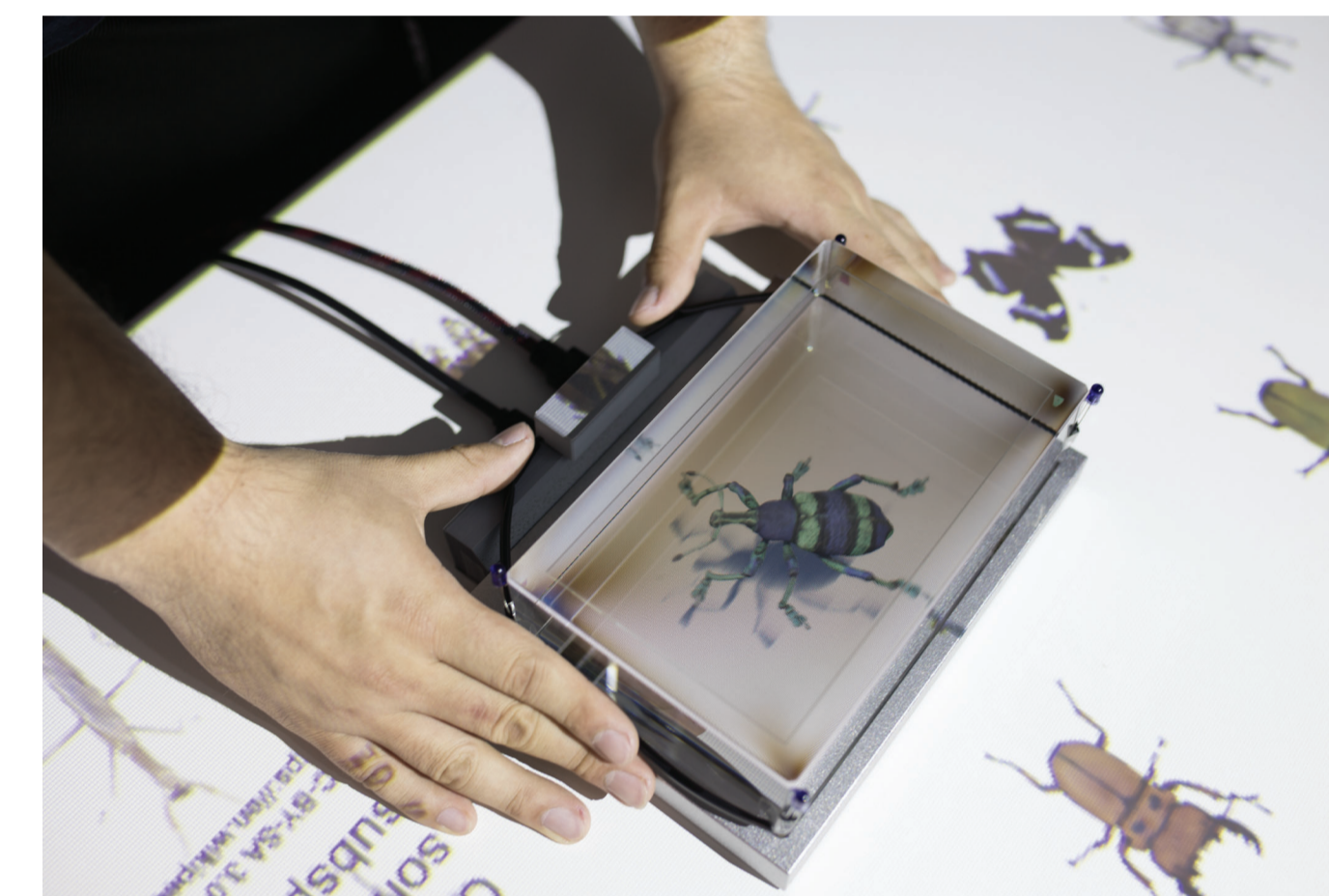


We attach LEDs on the four corners of light field display and track their positions with the infrared camera mounted above the table.

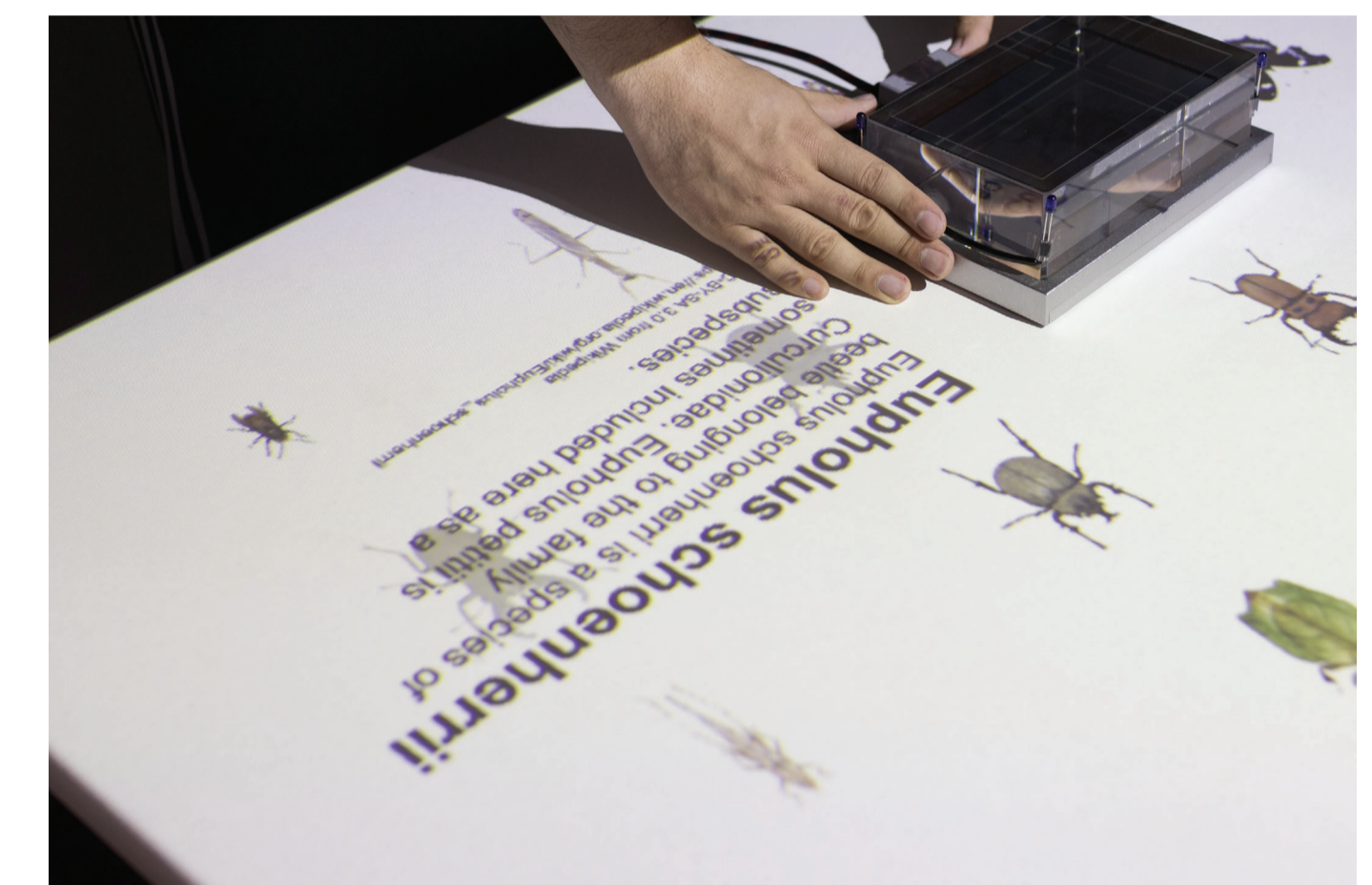
We detect the objects within the light field display area (green rectangle) and render them in 3D by using the light field display.

Applications

Insect specimen viewer allows users to overview all insect specimens in 2D, and observe the 3D shape of a selected specimen in detail.

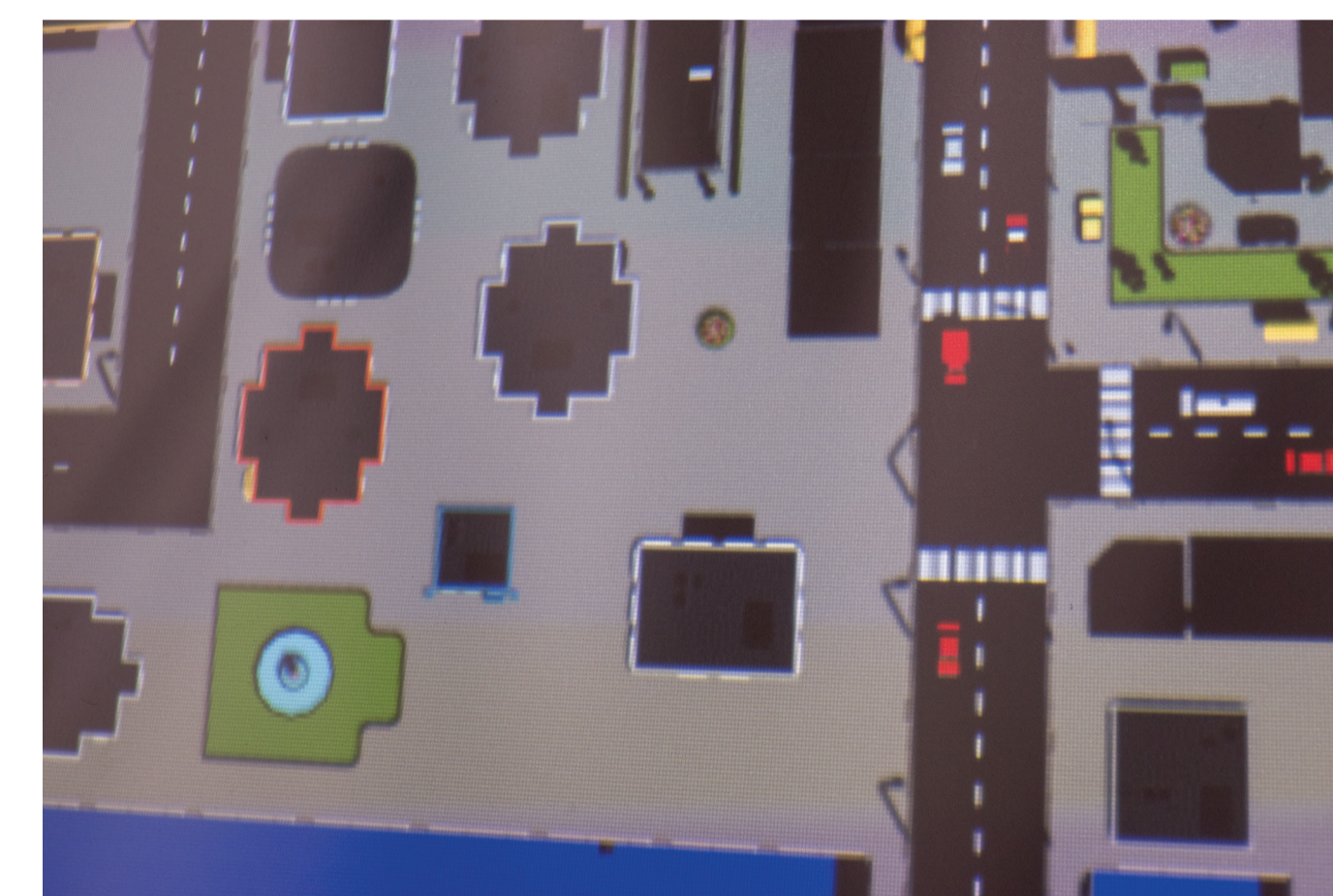


When the user places the pop-up display on an insect image, the system visualizes the target insect in 3D



The target insect is supplemented with text information displayed on the digital tabletop.

City map viewer displays large city map in 2D and display the buildings under the pop-up digital tabletop in 3D.



The 2D map of a city is displayed on the digital tabletop. the user places the pop-up display on this table.



The buildings under the pop-up display are observed in 3D. The user can check the sunshine condition of individual rooms.

Limitations & Future work

Limitations

- Current pop-up display cannot be viewed from side, since our light field display provides parallax images only in horizontal direction.

Future work

- Apply our system to various target
- drawing of industrial products or architectures
- scientific specimens, e.g., flowers
- Evaluation
 - Compare with pure 2D representation (i.e. books or photos) to confirm the feasibility of 3D visualization
 - Compare with pure 3D representation (i.e. 3D printed objects) to confirm the usefulness of our large-scale 2D navigation.

Acknowledgemnt

The 3D models used for our insect viewer were provided by Prof. Kenji Kohiyama. This work was supported by Grants-in-Aid for Scientific Research in Japan (17H01848, 15H05924).

References

[1] Looking Glass Factory. 2019. Looking Glass. <https://lookingglassfactory.com/>