

Alternative contactless optical surface reconstruction methods

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If you are building something, you want to be certain that the pieces have the correct shapes and sizes. Otherwise, they would not fit together. This thesis has looked into a technique that uses light to figure out what a surface looks like. How the light reflects off the surface can be used to figure out its shape, making it possible to quickly check if it looks as expected.

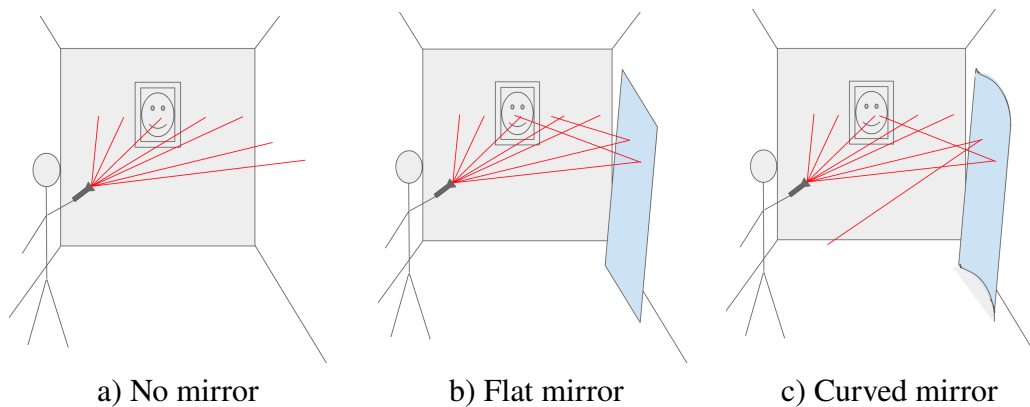


Figure 1: Shining a flashlight on a painting in a room with and without mirrors.

Imagine that you are shining a flashlight on a painting hanging on a wall as in figure 1a). If someone suddenly puts a large mirror next to you as in figure 1b), the wall and painting would suddenly become much brighter! But if the mirror looked as in figure 1c), a little bit less light would reach the wall. The technique that we investigate in this thesis tries to figure out exactly what the mirror looks like by only looking at how bright the wall is.

You might have already figured out that, as in figure 1, many different shapes can result in the same amount of light on the wall. But by shining the light on different parts of the mirror, and from different angles, we can actually learn what it looks like.

The technique that we suggest in this thesis uses common statistical methods to find relationships between the amount of light on the wall and the shape of the mirror. In essence, we look at the brightness of the wall and work our way backwards to figure out the shape of the mirror. The technique does not require any contact with the mirror and can be run in real time, which means that we can see how a force on the mirror affects its shape as the force is applied.

We hope that the technique proposed in this thesis can broaden perspectives and help people think outside the box when trying to solve a problem where the current common techniques are too slow or do not work for other reasons.