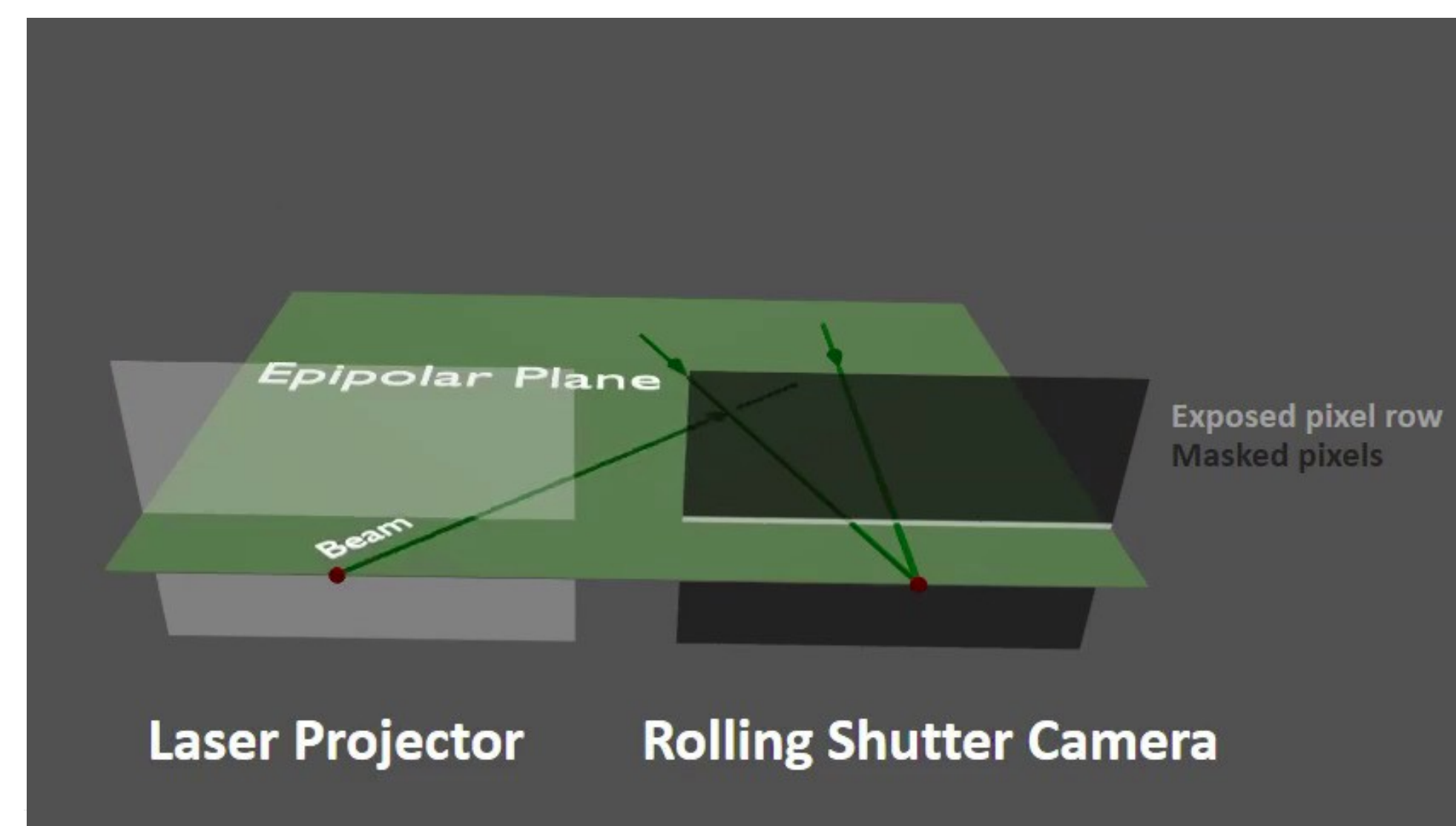


Introduction

Lil' Red, also known as the "Minebot" is a robot designed to go into caves and other areas not suitable for people to collect various types of scene data. The Episcan 3D is depth sensing camera that can create 3D models in real time using either structured light or active stereo. It also allows for multiple light imaging modes.

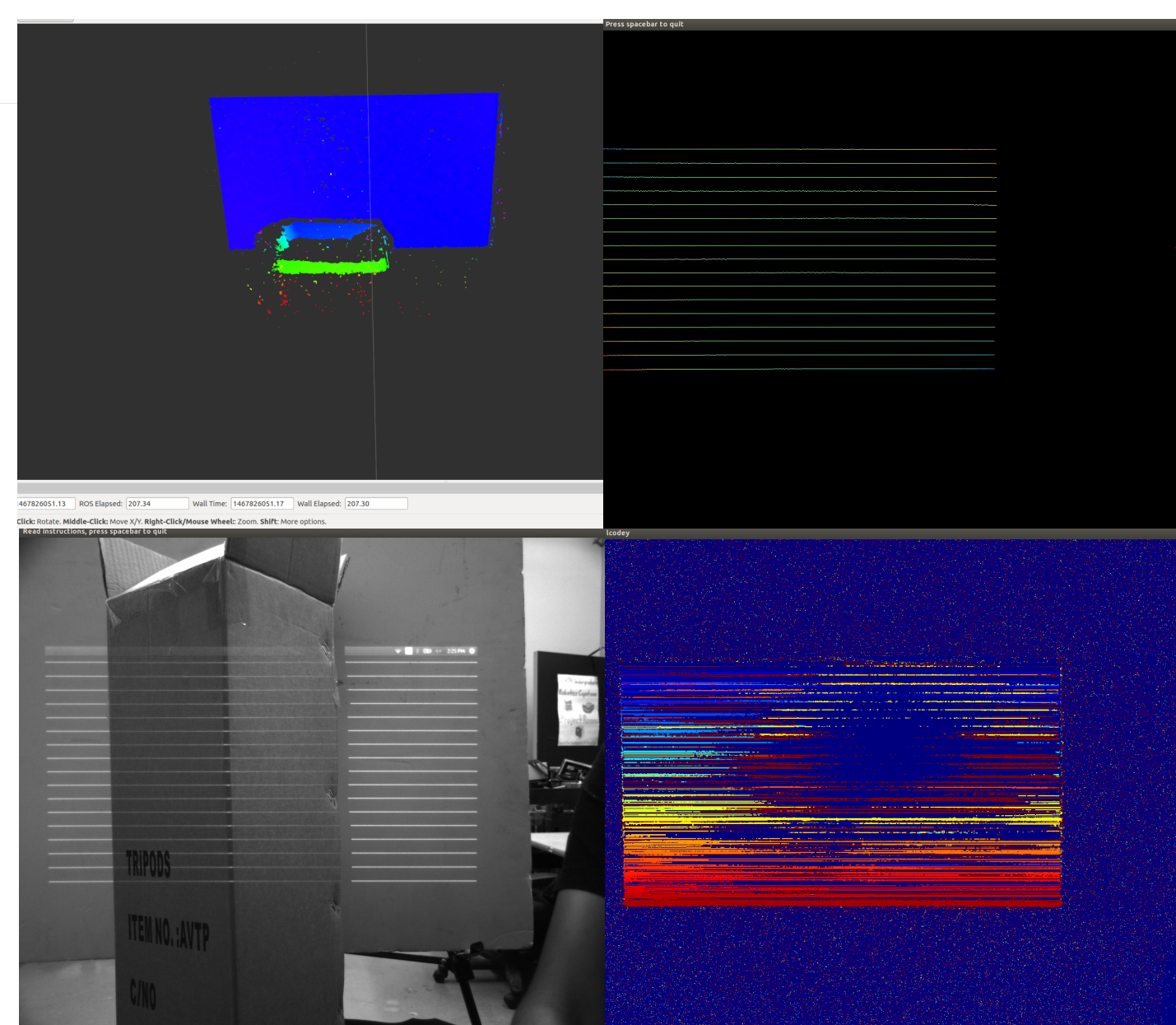
Episcan 3D

The Episcan 3D is very unique as it is able to work in scenes that have a very high amount of light. It works by using a vertical rolling shutter to read pixels that are being projected as they are being projected.

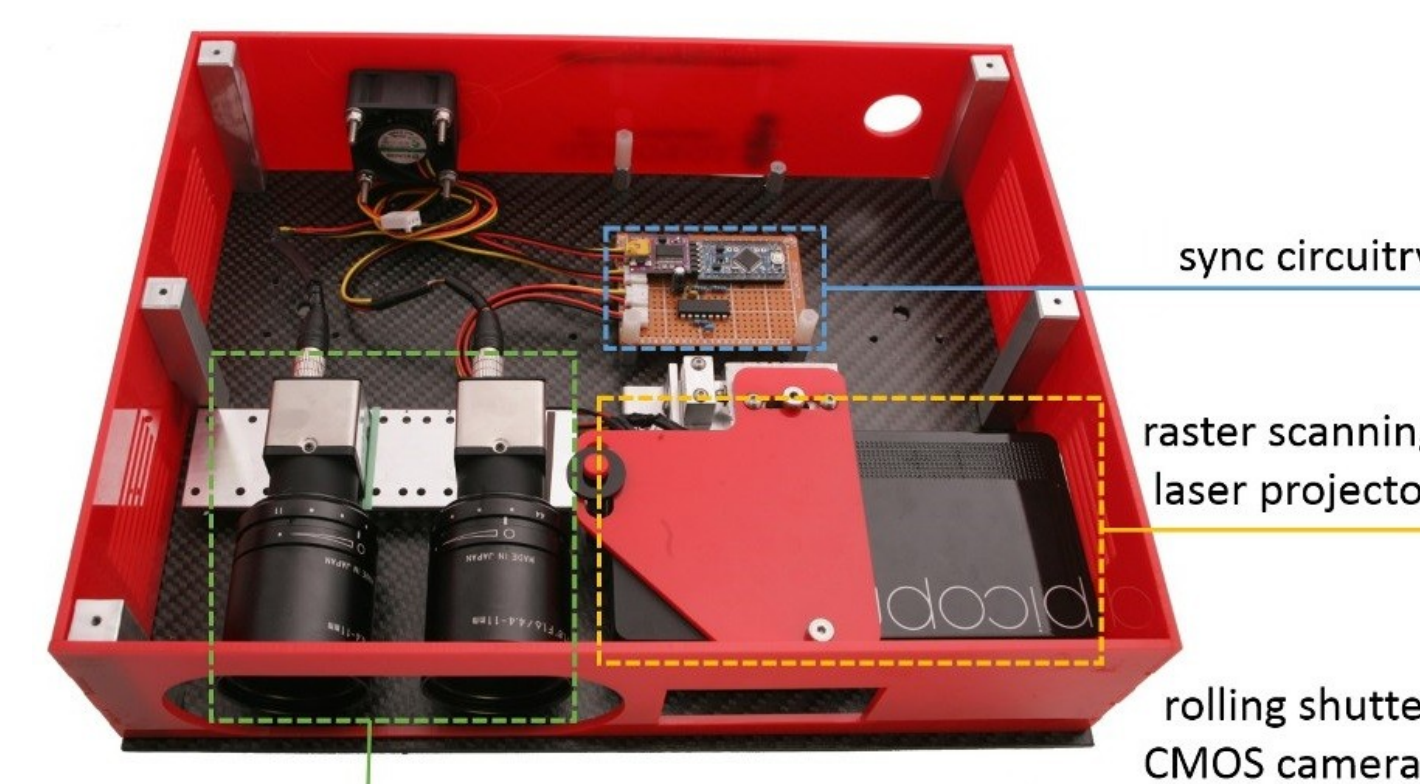
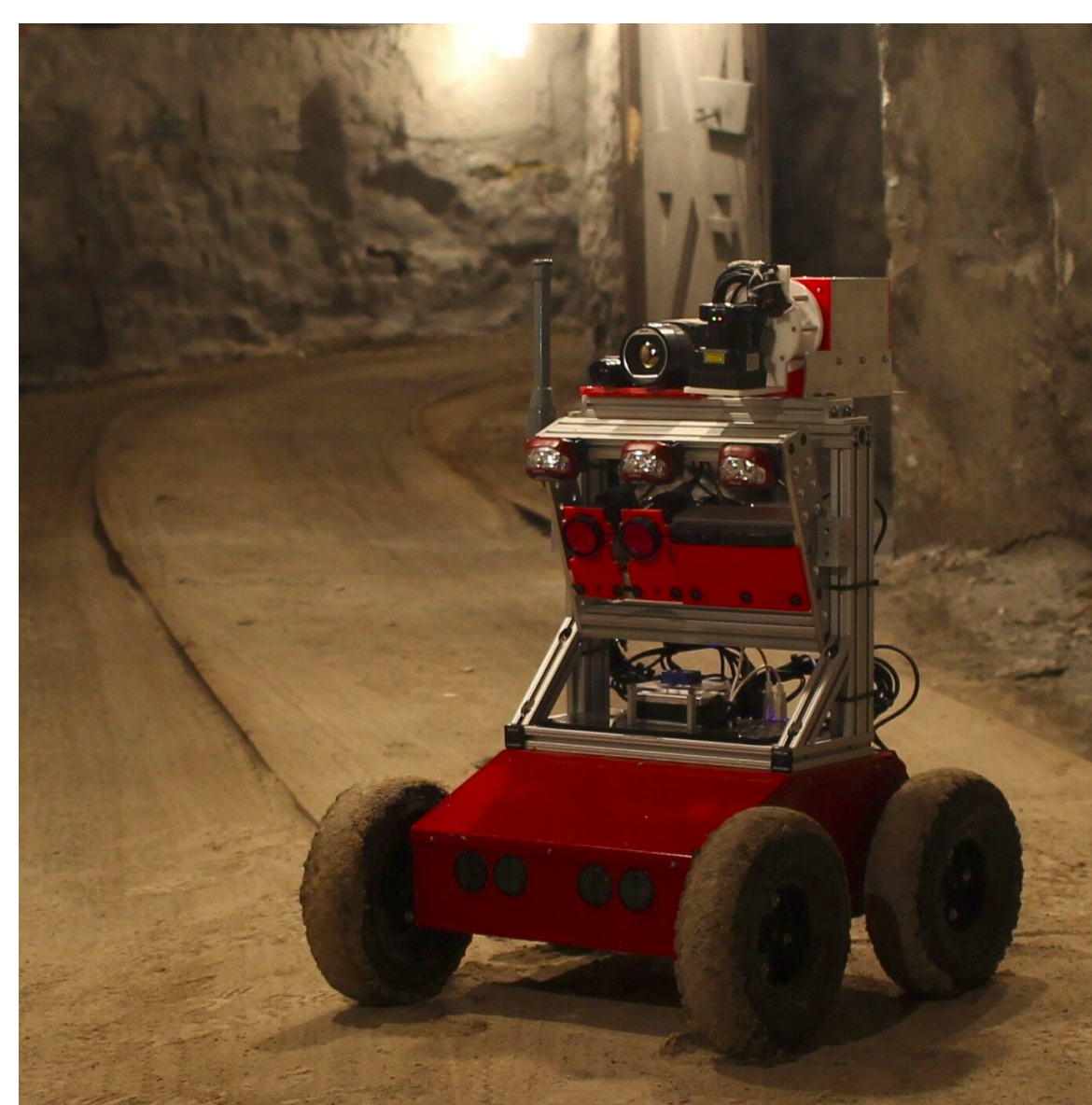


Calibration

The Episcan 3D works by having the two cameras read rows of pixels off of a projected pattern. For this to happen a very high degree of accuracy is need between the vertical alignment as well as the rotation.



The above images are all four types that the Episcan can produce. . Depth Map, Indirect, Global, and Direct



Imaging Modes

The images below depict a clear distinction between the indirect and direct lighting modes. The direct mode only shows light that is directly reflected, while the indirect mode only shows light that is reflected off surfaces.



Full Episcan

One of the major benefits of the Episcan is the Indirect Lighting Mode which was not directly implemented on the ROS end. This is a very useful image that can be used for recreating depth maps of transparent objects which the active stereo mode will miss. To do this 4 Images are needed: A general depth map, indirect lighting image, direct lighting image, and global image (normal photo)). Due to synchronization issues the cycle time is at round 2.4~seconds opposed to the ideal ~5.71.

Compatibility

Since the Episcan was coded on a standalone platform there were many compatibility issues and changes that needed to be made to run on Lil' Red's ROS platform. To do this . This lead to the ongoing integration of the Episcan's specific calibration programs into the ROS platform.

Camera Mounts

One of the major issues of using the Episcan on Lil' Red is that Lil' Red is a mobile robot and the Episcan needs to maintain calibration. The cameras are mounted at the base with two screws and the lens hangs off which can cause torque on the screws and perturb the calibration. This was originally solved by putting a mounting bracket around the lens. But due to the shape of the bracket extraneous force was being exerted on the lens which ended up disturbing the calibration. This is currently being solved by testing different designs that hold the lens steady while applying as little force onto the lens as possible.

Testing and Data Collection

One of the goals of the Episcan is to image and recreate 3D models of frozen objects and the frozen scene on Eurpoa. To emulate and test algorithms testing must be done on objects that are similar to what may be on Eurpoa such as various types of glasses and colored ice.

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