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Computer Graphics

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Literature Survey #1

Primary Paper:

- Time-of-Flight Cameras in Computer Graphics
- A. Kolb, E. Barth, R. Koch and R. Larsen
- Wiley Online Library / Computer Graphics Forum

Secondary Paper:

- Robust 3D-Mapping with Time-of-Flight Cameras
- Stefan May, Stefan Fuchs, David Droeschel, Dirk Holz and Andreas Nuchter
- IEEE Explore

The primary paper is about ToF cameras and their recent developments. Recent developments such as depth segmentation and better sensor detection and more. The paper also talks about different approaches to make better ToF cameras and also talks about errors that previous generation/current generation cameras have had. The secondary paper is similar to the primary paper but the secondary papers goes less in detail. The secondary paper talks about approaches to 3D mapping and camera errors just like the other paper. Talks about experiments and results just like the primary paper as well.

Both of these papers are also important. Both papers want to further research/investigate to make ToF cameras better. The primary paper specifically talks about current things that work good and bad. This is important because than improvements can be made on the specifically bad things. The secondary paper is important because it wants to specially improve calibration, depth measurements and more. In general, both of these papers are important because it helps future

works specify the issues to make the cameras better for various reason like movies, video games, and other things.

The primary paper starts off with a general introduction to ToF cameras. Than it goes on to talk about the approaches and the first one is intensity modulation approach. Explains a couple of functions and challenges with this approach like low resolution, systematic distance error and more. The authors also talk about the optical shutter approach. The author explains how to fix systematic depth error. Fixed using look-up tables or correction functions B-Splines. The fifth section of the paper talks about range image processing. Specifically talks about the distance and intensity values, monocular systems, and the recent technique to improve technique of range maps. The authors also talk about combining ToF cameras with other standard cameras to make them better. For example, this would make the ToF cameras have color resolution and better 3D imaging. A recent technique that is explained by the authors about making range maps better is that range maps and intensity images are linked together by shadow constraint. The authors also talk about the how ToF cameras are good at capturing 3D scenes especially with fisheye optics which improves the tracking of people. ToF cameras can capture objects as a depth map and can be constructed including shadows even from virtual objects. ToF cameras are also known to be really good at providing real-time, 3D interaction interface by detection had gestures and movements. The authors than do a short recap of the main topics they mentioned.

The secondary paper is similar to the primary but less in detail. It starts off with an introduction to ToF cameras and SLAM. SLAM stands for simultaneous localization and mapping problems. SLAM is used to locate the robot, targets, and more. This paper talks about how ToF cameras got into 3D mapping with approaches of calibration and appropriate filtering. The next section after the introduction talks about related works. One related work the authors

talk about is using multiple 2D laser range finders or a single continuously rotating laser scanner. The authors go on to talk about errors of ToF cameras just like the primary paper. The paper than talks about how 3D mapping is done in four steps. The first step is filtering. One type of filtering is jump edge filtering where the shapes aren't connected. The second step is map generation in which the authors talk about ICP algorithm. Third step is error relaxation and the fourth step is map refinement. Some results they found after the experiment is that incremental measures are more valid and suitable. Authors also mention that ego motion does not always result in an accurate map. Paper also states the results of calibration, light scattering, 3D mapping of laboratory scene, and mapping of larger environments. Papers concludes with a recap of their result of accurate 3D mapping from specific actions like reducing distance measurement errors, removing mismeasurements, and more. The authors will also continue with future work for better calibration, depth measurements, and more.

Both of these papers are similar and different. As mentioned earlier both talk about errors, improvements, and wanting to further research ToF cameras. The primary paper talks about ToF cameras recent developments and while the secondary paper also does that but in less detail. The secondary paper is more about how 3D mapping works. Both the papers are important because they have a similar goal in wanting the cameras to be better to be used in movies, games, and more. The authors of the primary paper talk about approaches to ToF cameras, improving range maps, what ToF cameras are good at, and more details. The secondary paper is about SLAM, how 3D mapping is done, results from their experiment, and more just like the primary.