

TOPIC MEMO

To: Robin Evans
From: Joshua Tang
Date: 10/21/2015
Subject: **Project Proposal: Creating a Monocular 3D Scanner for Android**

As 3D printing becomes cheaper and more widespread, and the barrier to game development becomes practically non-existent, several methods exist to create or purchase 3D models but there are very few methods that can be used to create 3D models from real world input and the few that do exist are very clunky to use, very slow and do not create good, easily editable outputs. The goal of this project is to create a Monocular(only using with one camera) 3D scanner that will function natively on most Android devices, that is easy to use, that creates a 3D model that can be edited in the app and be 3D printed or shared on social media.

There exist a wealth of research that has been done in the field of Computer Vision and the field of Robotics which make this project possible. Namely all of the SLAM(Simultaneous Localization And Mapping) algorithms are very important for this project as well as the dense and semi-dense probability mappings. The former let us understand where we are and what we are looking at while the second creates a basic model of what is being seen in a virtual space. This project will use the semi-dense probability mapping from ORB-SLAM to create a mapping of the real world. This mapping will be triangulated in order to create a mesh. Triangulation is the process by which we transform the unconnected points from the mapping in a number of connected polygons that make up the 3D model. The resulting model will be viewed and edited before being stored, 3D printed or shared on social media.

The project will be constructed first by using rapid prototyping techniques in order to get an understanding of how all of the different elements interact with each other to inform us of how to structure the final version of the project.

This proposal is intended for Gultekin Ozsoyoglu or whomever is the advisor for Senior Project next semester. The professor I am presenting this project to has a understanding of software engineering, but probably not much knowledge about Android development or Computer Vision algorithms. It is important that we inform the professor of the feasibility of the project by briefly explaining the basis of how the app works as well as referring to related work in the same field. The most important information to convey in the proposal will be the planned structure of the project, which software engineering techniques we are planning on using and the expected timeline of the project. We will also need to address what problem the app solves, though this is not of the utmost importance.

I will need to research a number of Computer Vision Algorithms related to Monocular SLAM, PTAM, DTAM, semi-dense and dense mappings. Researching these topics will permit me to learn how to use a single camera(which will in this case be the camera on an Android device) to be able to create the a mapping of the environment it is seeing, so that we can turn it into a mesh. I will also need to look at some papers on triangulation, especially triangulation for semi-dense maps.

We will first conduct a preliminary search on the topics mentioned above. We will then attempt to create a prototype utilizing some of the code published for this research topic. This prototype will run the bulk of it's code on a server as we want to make sure we get the algorithms right and it is easier to

test code running on a PC. We will all the algorithms in c++. The prototype will inform us on how the different conceptual parts of this project interact with each other. We will then conduct more research should it be needed and proceed writing a requirements document and a design document for the app and finally implementing it.

Upon completing this memo, I have done much of the initial research though I still need to finish writing a literature review.

This project will create something that doesn't yet exist, but that will help with the integration between the real world and the virtual world.