6.S078 Update

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1 Plan Progress

This past week has been filled with market and technology research. There is a large existing market in 3D scanning, with market revenue over $350 million in 2011. Automotive and aerospace are the largest end-user industries, followed by machine shops, metal fabrication, and heavy machinery. Other end-user industries include archaeology/museum curation, architecture, medicine, power generation, animation/special effects, consumer, and education. According to some analysis we found, the largest challenges facing the industry are high prices and complex user interfaces. This falls in line with our own perceptions about the industry. We also found that while it is typical for a large manufacturer to use 3D scanners for production verification, the high cost of 3D scanners prevents smaller manufactures from using them to the same end. We believe this is a targetable market, and to address this market we need to be precise enough to measure threading and bore diameter. For the growing consumer market, there are free or low-cost applications based off image reconstruction. Autodesk's 123D Catch is a popular free app, and there are systems based off using the Microsoft Kinect. There are limitations to the types of objects these kinds of systems can be used on (not effective on shiny, regularly-shaped objects, or when there is a regular background), and at the very least they require the user to move around the object and capture images, taking a significant amount of time. The resolution of their scans can also be lacking. Because these products are free, a consumer-targeted 3D scanner would need to be sure differentiate itself on some levels. We think resolution, variety of scannable objects, and level of automation are 3 factors a product could be differentiated by.

In terms of technology research, we started by looking at all the technologies currently used in 3D scanning, including computed tomography, opacity, contact probes, triangulation, structured light, time of flight, and image reconstruction. Computed tomography involves the use of x-rays, eliminating it as a low cost possibility. Using x-rays to scan interior parts of objects would be an interesting possibility, but we think for us it is best not to take that path. There are also interesting approaches possibly for time-of-flight scans, but the scan-speed to resolution trade-off that comes with time-of-flight is undesirable. Contact probes are effective, but slow and expensive, and we don't have any ideas to lower costs. We have decided that structured light is the most promising technology for us to pursue. Falling costs in digital projection and digital photography has recently lead to an increased academic attention on this approach, and there are even relatively straightforward ways for dedicated hobbyists to set up their own structured light 3D scanners. We think that combining methods intelligently (e.g. using image reconstruction alongside structured light scanning) could allow us to increase resolution, increase effectiveness on highly specular objects, and keep costs low. If done well, this would also allow us to push complexity into software and use cheap hardware.

In summary:

- We have narrowed our potential customers down to two markets: small manufacturers and consumers/hobbyists. Initial prototyping will be similar for either of these market segments, though for small manufacturers we need to focus more on scan accuracy of machining features, while for consumers/hobbyists we need to focus more strongly on simplicity of use.
- Structured light is the principle technology we plan to use for scanning. We think we can combine structured light with image reconstruction and stero-vision methods to increase accuracy.

2 Prototype Progress

We still do not have prototype progress, but we have build time scheduled this week.

3 Baffling Variables

We still have a large amount of uncertainty about the sizes of our potential markets, and the customer requirements for these markets. We have scheduled meetings that will help us answer our questions in these areas.

4 Seven Day Plan

- We have several meetings that scheduling has carried over from last week, so we are moving forward on those.
- On Wednesday we are moving into our new workspace, where we can start building and prototyping.
- Craig and Gus putting together a rough CAD model for a modular scanner composed of interlocking panels.
- Troy and Turner are putting together a basic structured light 3D scanner using a projector and a webcam
- Troy and Turner are pushing our prototyping funding search out to more places

5 People to Meet

We would like to meet with the course's VC advisors in order to try and get some prototyping funding

6 Desired Resources

Same as above section: we would like to get a hold of some funding for prototyping supplies.