

STEM Society Meeting, December 9, 2014

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Last Edit: 12/21/2014

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1 About the STEM Society and the STEM Society Website

STEM is an abbreviation for Science, Technology, Engineering and Mathematics. The acronym STEM is commonly associated with K-12 education, but our use of the term is only slightly bound to this meaning. There are over one hundred people on the mailing list, although a much smaller group attends any one meeting. We meet on the second Tuesday of each month at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The meetings are open to all. The start time is 6PM. We make presentations, have discussions, and have demonstration experiments. These relate to Science, the History of Science, Mathematics, Engineering, Philosophy and Technology at all levels. The topics have ranged from a technical discussion of the

mathematics of General Relativity to scientific experiments for young students.

These meeting notes contain links to many other documents, which may be viewed or downloaded by clicking the link. A partial list of documents can be reached by clicking the heading **Documents**. The meeting notes may also be viewed in an archive file (archive.pdf), which is in the list of documents. Many of the documents are PDF files. They may be viewed or downloaded to the computer by clicking, provided Adobe Reader, or another program capable of reading PDF files, is present. There are many more documents available at the site than are listed under **Documents** because the documents.htm file is not at all up to date. The last time I checked, about March 2014, there were about 350 document files on the site. We are in the process of creating better techniques for finding documents and authors. The first meeting of the STEM Society was in November of 2006. For several years we used the content management program called Joomla. It had a fancy looking interface, but was hard to use. It overran the space somehow at our internet provider Bluehost. So we now have a very simple HTML site. It is not so slick looking as Joomla, but very easy to maintain and modify.

The web site is:

<http://www.stem2.org/>

Direct to the documents list:

<http://www.stem2.org/je/documents.htm>

Direct to the archive file:

<http://www.stem2.org/je/archive.pdf>

2 The December Meeting Announcement

The December meeting of the STEM Society will take place on the second Tuesday of the month, December 9, 2014, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics:

(1) Ryan Rezzelle, head of forensic photography, at the Johnson County Crime Laboratory will address the STEM Society.

He operates their 250,000 dollar state-of-the art laser mapping device which is used to make on-site, instant maps of crime scenes. This device is made by Leica. He will bring the device to the meeting for a demonstration. Also, he will show imagery with power point. Geometric models of the scene can be created as well as holograms.

He mentioned no one under 18 should attend, because he will show photos of crime victims..... he asked if anyone was squeamish. He says he needs about 60-90 minutes.

(2) If there is time left after this talk we can discuss anything under the Sun if it is so desired.

The STEM Society Website:

<http://www.stem2.org/>

3 Ryan Rozzelli: 3D Laser Scanner Demonstration, *Rough Notes*

http://www.leica-geosystems.us/en/Leica-ScanStation-C10_79411.htm

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Ryan demonstrated the Leica ScanStation C10 3d laser scanner. The scanner sends out a laser beam, strikes a surface, and produces a reflection that is received back at the scanning station. The distance is determined by the time between the emission of the ray pulse and its received reflection.

The speed of light is approximately $c = 3 \times 10^8$ meters per second, thus it travels a distance Δx in time

$$\Delta t = \frac{\Delta x}{c}$$

If $\Delta x = 1$ millimeter, then

$$\Delta t = \frac{10^{-3}M}{3 \times 10^8 M/s} = 3.33 \times 10^{-12} s$$

So a device must be able to measure time down to a picosecond, and the pulses must be of very short duration.

Scanning a complete scene usually requires several scans at different locations, because some views will be obstructed by objects. The software can connect several scan images together. The software is named Cyclone, and has pattern matching algorithms, perhaps similar to the Photoshop software for merging images. It is able to create panoramic images. The machine can do 50,000 measurements per second. It does time of flight measurements, with a range of 300 meters outside, and will do 3.7 million points in a few minutes. Calibration is done at every measurement measurement.

Perhaps 150 crime scenes have been done in two years. The ScanStation cost about 150,000 dollars, and they have spent about 200,000 total for related equipment.

Ryan was with the KCMO police for 8 years, and with the Johnson County crime lab since then. He is from the East Coast, is a former University of Maryland football player, a very large person, and also attended George Washington University. I asked him if he wanted to wrestle me, but he declined. Ryan is the CCI supervisor at the Johnson County lab.

Point cloud data can be triangulated to create geometric models, and the data may be merged with Geographic Information System data with ArcGIS to provide the location of a crime scene.

Ryan was trained on the machine by scanning the liberty Memorial tower and Union Station. The position of the scanner is verified by NIST calibration. Johnson County has a new laboratory in Olathe. This activity was formerly based in a garage at the Johnson County DMI, which was shared with biological waste and such. The other branch of the Lab is called DNA and biology.

The machine has been used to do a detailed scan of the new lab in Olathe. Ryan moved to KC from the university of Maryland and George Washington

in 2000. There are probably about 250 similar 3d scanners in use around the US. Such scanners are also used in surveying and forestry.

Tom Grant asked about doing a scan of caves in Missouri. Ryan said the sheriffs office might be OK with Kansas caves, but probably not with Missouri caves. However Kansas does not have significant caves. The person from Leica who trained Ryan, was quite interested in cave scanning herself.

Ryan did a scan of the Trailside center room, which was done in a few minutes. And then talked about several crime scenes, including the recent Jewish community center killings. Another was a highway shooting, and a third was a multiple killing in a rural area of Kansas at a farm. Although we had been warned of some grisly scenes, we did not see blood and bodies.

It would be interesting to learn about the internal makeup of the scanner, the time of flight sensor, as well as the algorithms used to process the resulting point cloud. I suppose this would involve Delaunay triangulation techniques, which are related to Voronoi maps. We have talked about these in the past.

4 Tom Grant: Which falls first? The Ball Or The Feather? - Human Universe

This is a Youtube video. A ball and a feather falling in a giant vacuum chamber. Evidently from a BBC2 TV program.

5 Next Month: Tom Grant, Solar Panel Leasing