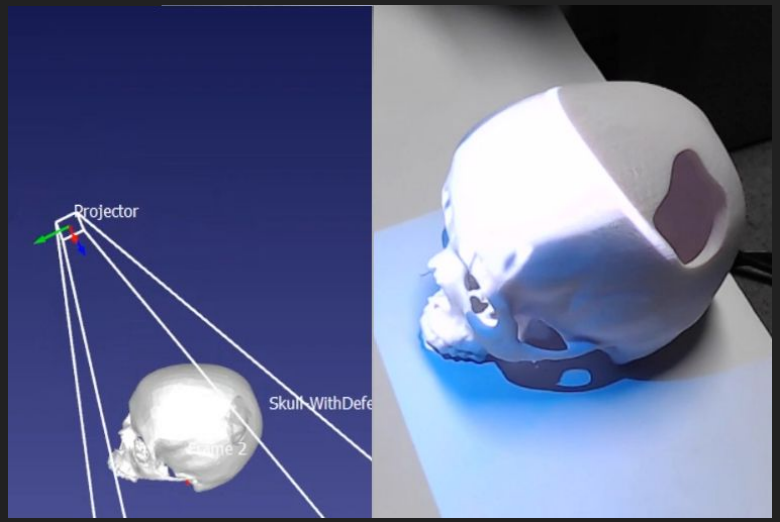
Projection Mapping in Surgery

Goal:

- Develop and demonstrate a handheld projector that projects patient data (e.g. CT/MRI scan model) onto patient body in real-time display visualizing the registration of the model while performing 3D scan to acquire surgical data.



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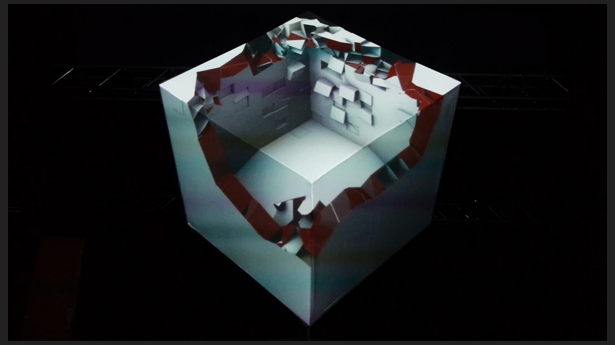
Background:

- Projection mapping, similar to video mapping and spatial augmented reality, is a projection technology used to turn objects into a display surface for video projection. A two- or three-dimensional object is spatially mapped on the virtual program which mimics the real environment it is to be projected on.
- In recent years, projectors have come down surprisingly in wide range of size that encompass brightness and different features.



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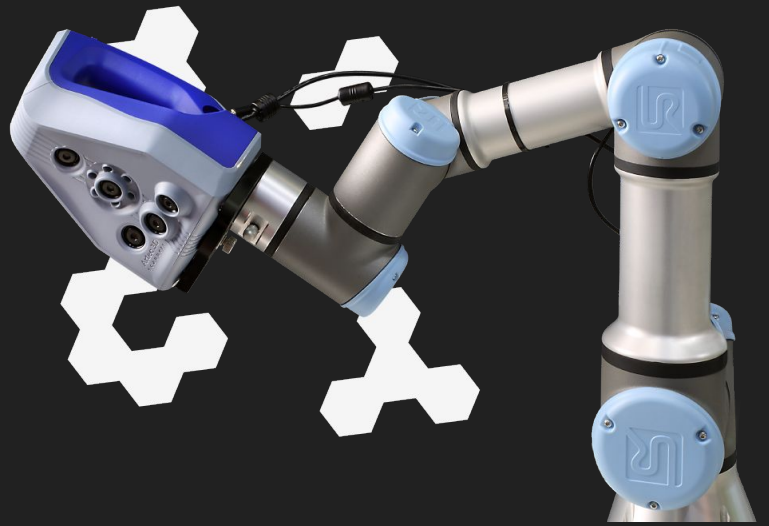
Background (continued):

- There are many 3D scanners available on the market nowadays. Handheld 3D scanners are gaining popularity in this fast-growing market, because they offer flexibility and allow the 3D capture of complex scenes or objects.



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What Student Will Do:

- Develop an integrated handheld projector & 3D scanner for intraoperative projection of patient model onto the anatomy of interest and scanning the necessary area to acquire surgical data.
- Develop registration and projection mapping software.

Deliverables:

- Develop a handheld projector integrated with a 3D scanner device
- Show the feasibility in Cranioplasty

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Group Size:

- 1-3 students

Skills:

- C++, Python Programming
- Geometric Mesh Processing
- Image Processing (Registration)

Mentors:

- Dr. Mehran Armand
- Joshua Liu

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Related Info:

- Yi Zhou, Shuangjiu Xiao, Ning Tang, Zhiyong Wei, and Xu Chen. 2016. **Pmomo: Projection Mapping on Movable 3D Object**. *In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16). ACM, New York, NY, USA, 781-790.* DOI: https://doi.org/10.1145/2858036.2858329
  - Youtube Demo: https://www.youtube.com/watch?v=Y5-Q_C9g2W8
- Lightform: https://lightform.com/
  - Youtube Demo: https://www.youtube.com/watch?v=zKAzVr8ULF4
- Projection Mapping Tools:
  - http://projection-mapping.org/software/