Proposal Title: BUILDING AN AUGMENTED REALITY SANDBOX

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Proposal Summary

This proposal requests funding to support the development of a "augmented reality sandbox" for use in introductory physical geology, historical geology, and physical geography laboratories. An augmented reality sandbox (ARS) is a 3-dimensional, interactive, and dynamic educational tool to help understand mapping, topography, watersheds, and many more topics related the earth and environmental sciences.

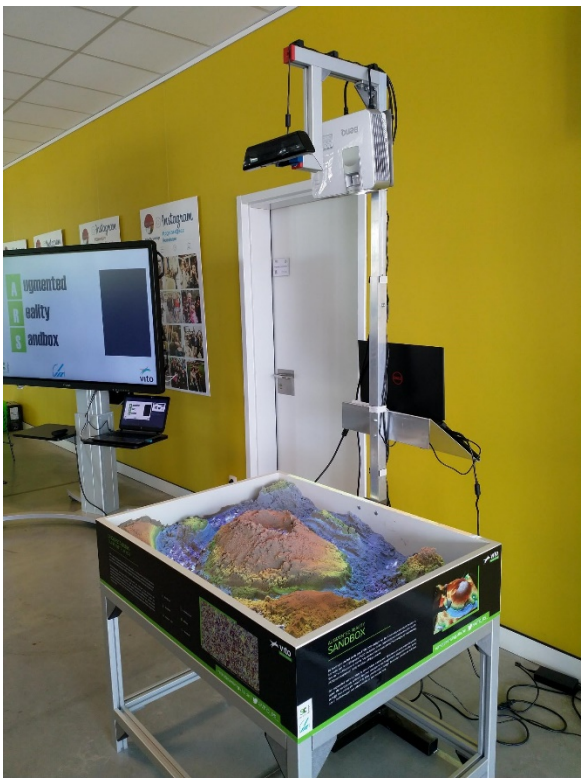

Figure 1. Example of a student built ARS system at Sint-Clara college.

A basic ARS system consists of computer running specialized software, projector, and a motion sensor to map contour (isopach, equal elevation) lines onto a surface of sand (Figure 1). The ARS system is able to adjust the projected, color coded, elevation levels of the sand in real-time. As the sand is moved by the observers, the ARS system automatically adjusts and projects new features onto the sandbox. Students can pile sand to make hills and mountains, dig depressions to make valleys or bodies of water, channels to simulate rivers or canyons, or even islands. In addition, by holding one's hand above the sandbox, but between the sandbox and the projector, your hand would be recognized as a "cloud" by the software and the projector would simulate rainfall and subsequent runoff.

Users of ARS systems have reported it as "cool" and "really addictive."

Educational Usage/Project Narrative

Courses Impacted, Spring 2021:

GEOL 1403, multiple laboratory sections; projected enrollment: 250
GEOL 1404, multiple laboratory sections: projected enrollment: 130
GEOL 1405, multiple laboratory sections; projected enrollment: 125
GEOG 2342, multiple sections; projected enrollment: 60

Introductory physical and historical geology and physical geography laboratories all have labs dedicated to the understanding and interpretation of maps. Students in those classes would be able to use an ARS system to gain a better understanding of concepts such as contour lines, contour intervals, watersheds, topography, and drainage basins. Students in more advanced courses like cartography or surface water hydrology would be able to model streams and rivers, build dams or wetlands, and even create "virtual" rain on the landscape that flows downslope!

Total enrollment in the aforementioned introductory courses is generally several hundred students per semester. Therefore, we believe the ARS system would have a far-reaching impact.

The ARS system could be placed in a public place in the Lee Drain Building and students not enrolled in a geociences course would be able to "play" with the ARS system (COVID willing), which may pique their curiosity and lead to a better understanding for non-STEM majors or even possible recruitment of undecided students.

A better understanding of how and why and ARS system works can be had by watching the following video link: https://www.youtube.com/watch?v=CE1B7tdGCw0.

Budget

All monies received through this grant will be spent to acquire the needed software, hardware, and materials to construct an ARS system. No faculty stipend is requested.

Commercial systems can be purchased but are not cost effective. Expertise within the department along with multiple papers detailing how to construct an ARS system on "the cheap" will allow us to construct a relatively inexpensive ARS system.

Major budget items include the specialized software, computer system, motion sensor, and materials for the structure of the ARS system. While we anticipate that the total cost of the system may exceed the funding available, the department may be able to supplement the shortfall.

Total Budget Request: $2,000.

Project Timeline

We anticipate beginning construction on the ARS system soon after receiving notification of the funding in December 2020.

Needed software and hardware would be purchased as soon as possible and simultaneous construction of the ARS infrastructure would begin soon after notification of the award.

We plan to have the ARS system up and running by late January or early February, 2021 for use in our introductory laboratories during the latter half of the spring semester.