Invention ID:	**2020/033-170**		
Title:	**Intuitive Optical Design with Web Technologies**		
Technology ID:	**170-2110**	**Type:**	**Disclosure**
Submitted By:	**Eric Edlund**	**Updated Date:**	**5/14/2020**
Original Submitted Date:	**4/23/2020**	**Last Submitted Date:**	**4/23/2020**
Stage:	**Approved**	**Status:**	**Disclosure Evaluation**

Campus Location

Campus Location
Select the name of the SUNY campus where you developed the innovation (if more than one inventor/location, select the primary campus of the lead inventor).

170 Cortland

PLEASE BE ADVISED

Description of Innovation

What kind of innovation are you disclosing?
Please select the closest description to the innovation you are disclosing. If you are uncertain which to choose, please contact us at patents@rfsuny.org to request guidance.

Software

A) Detailed Description of the Innovation
Please provide a detailed summary of the innovation. Identify clearly what you consider your innovation to be, including materials/methods used, operation, and utility, focusing on unique features that distinguish it from existing intellectual property/technologies. Describe in such detail as to enable a person skilled in the art to make and use the innovation. SUBMIT PICTURES, CODE, DATA TABLES, MANUSCRIPTS, NUCLEOTIDE/AMINO ACID SEQUENCES, ETC., AS APPLICABLE, UNDER DOCUMENTS SECTION, BELOW.

This invention disclosure describes two related aspects of an invention: a new design concept for optical-system engineering, and the actual software program that encompasses these and other methods.

The central aspect of the new design method is a "path-first" approach to optical component layout. What this means is that the user defines the optical axis in a 3D space and then places components along that axis. The path-first method mirrors the thought process of the engineer at work, where the path of the optical rays through space is visualized with its purpose. This method stands in contrast to existing design methods that require the user to place and orient individual optical elements in sequence, slowly building up the optical path by a series of tedious calculations that define the direction of propagation for the optical rays. This can often be confusing since the actual ray reflection angle is different from the orientation angle of a mirror, and becomes especially complicated for non-planar and non-spherical optics.

A further consequence of the path first approach to design is that once the path is defined by the user, the software can easily solve for the angles of the optical components require to steer the beam on its path. By offloading such calculations to the computer, the user is freed to pursue the creative aspects of the design process. This also creates a generally more robust design process since most errors are introduced in calculating the orientation angles of the optical components.

The commercial goal of this project is to create a software program for distribution, perhaps with different licensing options for educational, research, and commercial applications. The first version of the software prototype uses functions from the "threejs" libraries that have been developed for online 3D gaming. These are very efficient routines that provide many functions ideal for our purposes, such as collision-detection functions. In the context of an online game this collision-detection function could be used to find the collision of a bullet with objects in its path, for example. In the context of our optical code this is used to determine the intersection of an optical ray and a mirror, for example. These methods will allow quick expansion of the software to include non-spherical optics and other advanced calculations, as well as sophisticated 3D rendering of the virtual object environment.

Demo executables for both Mac and Windows systems have been created but are too large to upload or email. Please contact Dr. Eric Edlund to request an alternate means for sharing files.

B) Problem Solved or Need Addressed by the Innovation
Describe the problem solved/market need addressed by the innovation disclosed. As part of this description, list as many actual/hypothetical products/services you can think of that might benefit from the innovation disclosed. Identify the customer/end user for each. Be creative: attempt to think of broader and narrower applications, including those outside of your field.

The goal of our optical design software is to eliminate needlessly tedious tasks by offloading calculations that are ideally suited to computers so that the user is freed to focus on the more creative aspects of the design process. The flexibility in this approach to design means that the same software can be used in the following areas:
1. high school and college courses as a tool for teaching/exploring fundamental optics,
2. academic research labs where researchers design custom optical systems for experimental purposes, and
3. professional and industrial optical design for commercial products.

Software Addendum

1) Describe the circumstances that led to development of the software.

Professor Edlund has worked with optics in a professional setting since 2003 when he began his graduate studies at MIT. Throughout this time he has worked with a variety of optical design codes, including programs created himself, programs created by colleagues, and commercially available codes like Zemax and OSLO.

Throughout all of this, and especially when working with the professional codes, Dr. Edlund noticed that even the professional, commercial codes seemed lacking in some fundamental user-interface features and were very frustrating in other ways. These experiences led him to start thinking about what he wanted in an optical design program. Nathaniel Rose started working with Dr. Edlund in the summer of 2018 during a summer internship where they began a project to start implementing these ideas. After almost two years of effort they have developed a working test version that is moving in the direction of a tool that is simultaneously intuitive and powerful. There are many further developments that the code needs to become a successful commercial product, but the core methods and relationship between the code and the user are now well-defined and are established in a proof-of-principle first version of the code.

2) Identify any non-software knowledge resources that were used in developing the software.
(e.g., subject matter experts, scientific/engineering literature resources, etc.)

The core elements of the mathematics behind the optical design are well-known to Dr. Edlund from years of field experience. The core elements of html and javascript are well-known to Mr. Rose. Multiple online forums and websites were used in helping to implement the threejs library into this work.

3) What, if any, pre-existing software from other sources (including open source code) have you incorporated into the software?
In each instance, describe the pre-existing software component and what function it serves. Identify its source and attach the relevant license/other permission allowing you to utilize the pre-existing software.

The 3D rendering and collision-detection functions are drawn from the "threejs" library. This library is distributed for public use under the MIT open license: https://github.com/rohitvarkey/three-js/blob/master/threejs/LICENSE.

4) Approximately what percentage of the software code is new vs. pre-existing (as identified in Section 3 above)?

0.90

5) Identify any linked content.

If linked content is used, identify and provide the license(s) for such content.

None.

Copyright registered?
Check box if Yes.

N

Applied for copyright registration?
Check box if Yes.

N

Funding

Inventors

Inventors

First Name	MI	Last Name	Email	Significance	Contribution	Role Type	Address	Working For Company	Working For Department
Eric	M	Edlund	eric.edlund@cortland.edu	1	70.00 %	Primary	133 Bowers Hall 38 Graham Avenue Cortland NY United States	SUNY College at Cortland	170 Physics
Nathaniel	G	Rose	nathaniel.rose@cortland.edu	2	30.00 %	Student	1111 Bowers Hall 38 Graham Avenue Cortland NY United States	SUNY College at Cortland	170 Physics

1) U.S. Department of Veterans Affairs Affiliation
Please check the box above if any of the inventors listed above hold an appointment or are employed, with or without compensation, by both the U.S. Department of Veterans Affairs and SUNY.

N

2) Nature of Each Listed Inventor's Contribution
Please describe the nature of each inventor's contribution to the development of the innovation disclosed. (Format: Inventor 1 Name: contribution; Inventor 2 Name: contribution; etc.)

Eric Edlund:
Concept originator and optics algorithm design

Nate Rose:
programmer and user interface design

Documents

Documents

File Name	Created By	Date Created
2020/033-170 Original Approval.pdf	Katherine Ashton	4/27/2020

Interests

Interests

engineering, optics and photonics, software

Remarks

Technology

Technology

Tech ID	Title	Manager	Status	Disclosure Date	Status Date
170-2110	Intuitive Optical Design with Web Technologies	Katherine L Ashton	Disclosure Signature Pending	4/27/2020	4/27/2020

Patents

Subscribers

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Also, all inventors hereby agree to cooperate fully with the Foundation in the preparation, filing, and prosecution of any patent applications, or copyright and trademark registrations, as well as in any investigations of sponsorship, inventorship, use of SUNY resources and facilities, Scope of Employment, and any other facts or matters deemed necessary by the Foundation to its effective evaluation and management of the intellectual property described herein.

Digitally signed on 4/27/2020

Eric M Edlund (Primary 70.00 %) Date

Digitally signed on 5/12/2020

Nathaniel G Rose (Student 30.00 %) Date

Digitally signed on 4/27/2020

Witness Signature Date

Digitally signed on 4/27/2020

Witness Signature Date