Project14 I Photonics: Build Projects that Involve Lasers, LEDs, Phototransistors, LiDAR, ToF Cameras, and More!

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Photonics
Project14 **Enter Your Electronics & Design Project** for a chance to win an $200 Shopping cart of product!
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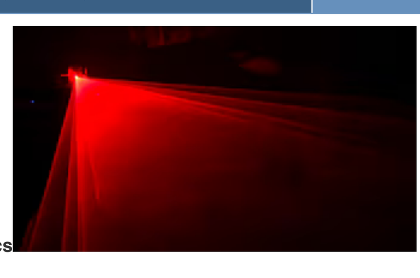
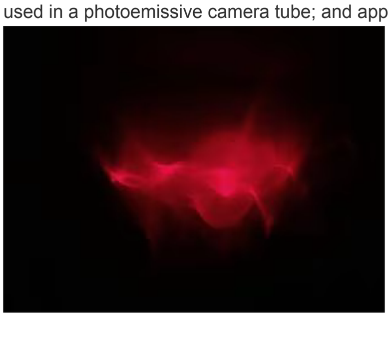
In the Comments Below Let Us Know Your Ideas for Projects Around Photonics!

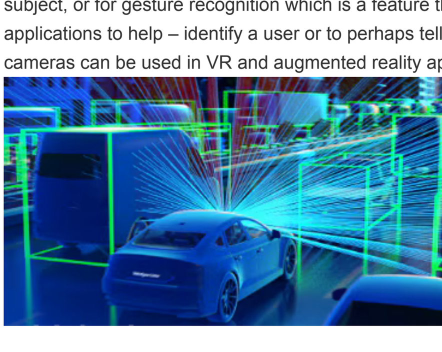
Photonics, Photons, and Quantum Mechanics | Phototransistors, MASER to LASER, and LEDs

Photonics 

The theme this month is Photonics and it comes from an idea from neuromodulator. Your project can be anything involving or exploring lasers, LEDs, phototransistors, LiDARs, TOF cameras, and more! Photonics is the science of light. It is derived from the Greek word "phos" which means light. It emerged as a field in 1960 with the invention of the laser and although the term was coined earlier, it came into common use in the 1980s with the adoption of fiber-optic cable by telecommunications companies, making the digital age we live in possible. Amongst the things that photonics has made possible are high-speed internet, laser tattoo removal, LASIK eye surgery, and infrared goggles. Your project can involve anything that uses optoelectronic components to source, detect, and control light. This includes any applications that study how photoelectric or photovoltaic effect is used photodiodes (such as solar cells), phototransistors, photomultipliers optoisolators, and integrated optical circuit (IOC) elements; photoconductivity used in photoresistors, photoconductive camera tubes, and charge-coupled imaging devices; stimulated emission used in injection laser diodes and quantum cascade lasers; lossev effect or radiative recombination used in: light-emitting diodes (LED) and OLEDs; photoemissivity used in a photoemissive camera tube; and applications related to optocoupler and optical fiber communications.

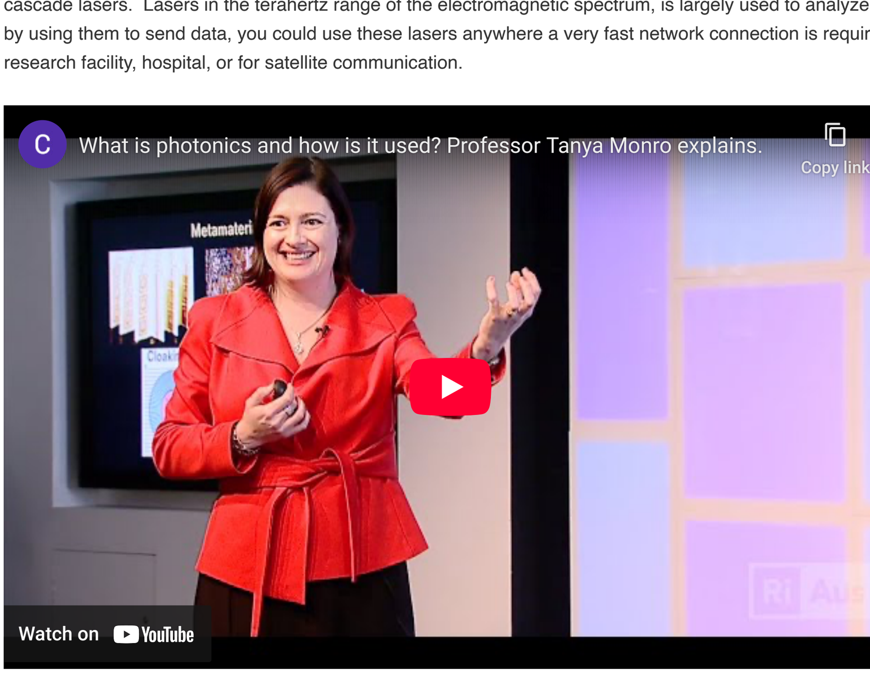


Photonics is shaping some of the most exciting developments in the world. In automotive, object/obstacle detection, collision avoidance, identification/classification and tracking, blind spot detection, lane keeping, adaptive cruise control, and parking assistance well placed cameras and a well placed cameras and a light based version of radar known as LiDAR. Light detection and ranging along with artificial intelligence are key to autonomous vehicles as they tell your car where its safe to drive and if there are any roadblocks. A network of light detection and ranging (LiDAR), time-of-flight, and visual instrumentation is being incorporated for both advanced driver assistance systems (ADAS) and fully autonomous vehicles. In addition to their use in advanced driver assistance systems (ADAS) and autonomous vehicles, Time-of-flight cameras, or ToF cameras, are becoming increasing common on mobile phones, drones and industrial robots. These cameras map out surroundings to create a basic three-dimensional representation of what is in front of them. When used on a drone or a car to help it can be used for object/obstacle detection, for instance. ToF can also be used can also be used for identifying a subject, or for gesture recognition which is a feature that is also finding its way in ADAS. ToF can also be used for security applications to help – identify a user or to perhaps tell the difference between a human intruder or a neighbor's pet. ToF cameras can be used in VR and augmented reality applications to overlay a virtual world on the real world.

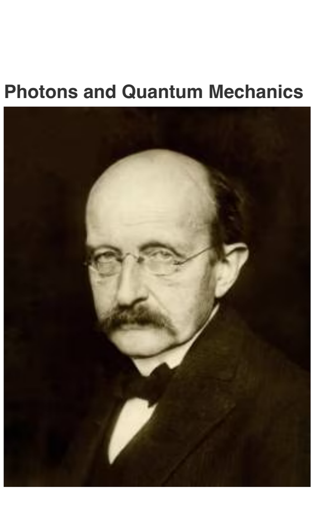


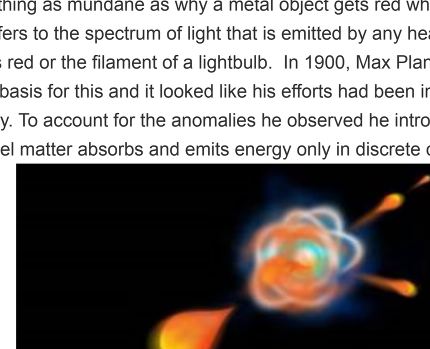
In agriculture, a technique known as precision agriculture a drone carrying a sensor provides detailed information on crops that was never possible before. The sensor sends out infrared and ultraviolet rays to measure the chemical makeup soil, crops, and everything below the surface. This allows farmers to know exactly whether a crop is receiving too much water or fertilizer, and can apply both only as needed. This same sensor can also be used on a conveyer belt to examine harvested vegetables for deep bruising or to measure the sugar or water content in a vine of grapes. In medicine, a common surgical procedure known as an endoscopy uses light and ultra-tiny optical fibers to perform less invasive-surgery. An endoscopy, allows a surgeon to makes a smaller incision, as opposed to open surgery, allowing patients to recuperate faster. During the procedure an optical fiber with a small camera attached snakes through your body and the surgeon can view the fibers movement on a high definition monitor next to the patient. This procedure can be used for knee surgeries, removing gall bladders or tumors, inflammatory bowel disease (IBD) such as ulcerative colitis (UC) Chron's disease, to remove sample tissue for an endoscopic biopsy, determine the cause of abnormal symptoms and colonoscopies among other procedures.

Lasers continue to change our lives and will continue to do so in ways that are unimaginable now. For example, a recent breakthrough could allow data to be transferred 1,000 times faster than current internet wires using terahertz quantum cascade lasers. Lasers in the terahertz range of the electromagnetic spectrum, is largely used to analyze chemicals. But by using them to send data, you could use these lasers anywhere a very fast network connection is required such as in a research facility, hospital, or for satellite communication.



Photons and Quantum Mechanics



In the 1860s, James Clerk Maxwell unified the fields of electricity, optics, and magnetism to form the basis of our modern understanding of electromagnetism. In 1887 Heinrich Hertz demonstrated the existence of such waves by producing what is now known as radio waves in his laboratory. Hertz's experiment used two rods to serve as the receiver and a spark gap as the antenna. A spark would jump when the wave was picked up. His oscillator demonstrated that the velocity of radio waves was equal to the velocity of light, proving radio waves were just another form of light, and how to detach electric and magnetic waves from wire. His verification that these waves travel at the same speed as visible light, and measurements of their reflection, refraction, diffraction, and polarization properties were a convincing demonstration of the existence of Maxwell's waves. However, Maxwell's wave theory does not account for all properties of light. The shift from quantum mechanics began with something as mundane as why a metal object gets red when it is heated. This is known as blackbody radiation which refers to the spectrum of light that is emitted by any heated object such as what happens when an electric stove burner turns red or the filament of a lightbulb. In 1900, Max Planck had spent six years attempting to understand the fundamental basis for this and it looked like his efforts had been in vain because experimental data revealed an error in his theory. To account for the anomalies he observed he introduced the concept of the energy quanta, the idea that at an atomic level matter absorbs and emits energy only in discrete chunks, not to the continuous degree predicted by classical physics. 

Even Planck was hesitant to embrace this aspect of his theory but it did not take long for Einstein to take this concept and run with it. In 1905, Einstein published "Concerning an Heuristic Point of View where he proposed that light traveled not as a wave but as some manner of energy quanta. This new way of understanding light, as packets of energy that would be later referred to as photons offered insights into the behavior of nine different phenomena, including the specific colors that Planck described being emitted from a light-bulb filament. It also explained how certain colors of light could eject electrons off metal surfaces, a phenomenon known as the "photoelectric effect." In 1909, while considering light's momentum, he discovered that light behaves as both a particle and a wave, exhibiting the wave-particle duality that would only work under quantum mechanic theory. In 1917, he introduced the concept of stimulated emission; where a photon interacts with an excited molecule or atom and causes the emission of a second photon having the same frequency, phase, polarization and direction. This became the theoretical basis for the laser, an acronym that stands for "Light Amplification by Stimulated Emission of Radiation".

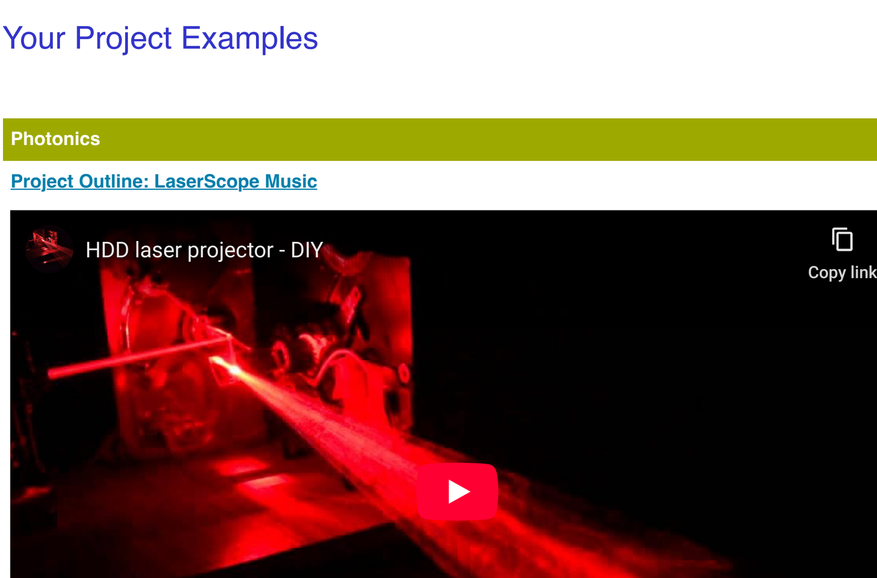
Your Chance to Win

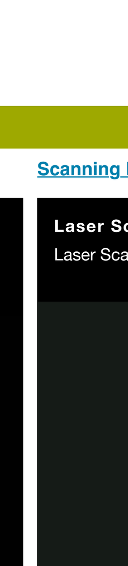
Be Original	Stick to the Theme
• You could come up with a clever name that make's your project memorable! ◦ This project is your baby! Part of the fun of bringing something new into the world is coming up with a name. • Your project could introduce something new or that is not commercially available or affordable!	• If you have an idea for a project that doesn't fit the current theme then submit your idea in the comments section of the monthly poll.
List the Steps	**Submit Video Proof**
• Provide the steps you took to complete your project (text, video, or images). ◦ This could be a step by step how-to-guide, vlog, schematics, coding, napkin drawings, voice narration, or whatever you think will be useful!	• If it doesn't work that's fine, this is more about the journey than the end product. • A short video is all that is required but you can shoot as much video as you like. • **You are encouraged to be creative and have as much fun as possible!**

Your Project Examples

Photonics

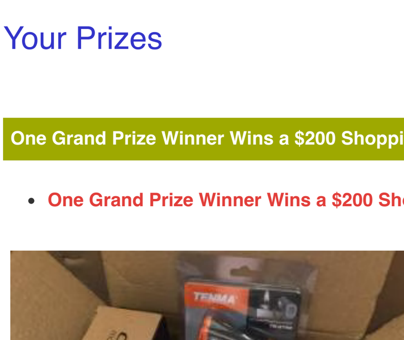
Project Outline: LaserScope Music | Scanning Lase

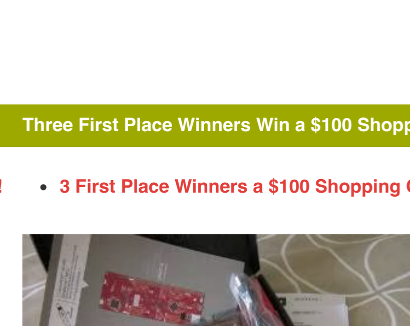




Your Prizes

One Grand Prize Winner Wins a $200 Shopping Cart!	Three First Place Winners Win a $100 Shopping Cart
• One Grand Prize Winner Wins a $200 Shopping Cart!	• 3 First Place Winners a $100 Shopping Cart!





Your Project, Your Ideas!

About Project14

Every month you'll have a new poll where you'll get to decide an upcoming project competition, based on your interests, that will take place a couple of months in advance. Themes are broad in scope so that everyone can participate regardless of skill set.

What are Monthly Themes?

- Every month (around the 14th of each month) a new theme will be posted on Project14.
- Submit your ideas (proposals) for your projects to get feedback from the rest of the community.
- Submit a project entry in the Theme space once you start working on it.

What are Monthly Theme Polls?

- Every month (around the 14th of each month) there is a project theme poll.
- Vote on which project competition you want to see for the *following upcoming* theme.
  - The themes voted on during the *previous poll* decided the *upcoming theme.*
  - If you submit an idea for a theme that is not used then it can still be used in a future poll.
- Themes comments and ideas from the comments section of the project theme poll.

Directions

Step 1: Log in or register on element14, it's easy and free.
Step 2: Post in the comments section below to begin a discussion on your idea. Videos, pictures and text are all welcomed forms of submission.
Step 3: Submit a blog post of your progress on your project by the end of the month. You are free to submit as many blog entries as you like until the beginning of the next theme.

Be sure to include video proof of your project!

Visit: Photonics or tag your project blog PhotonicsCH

You have until April 14th End of Day to submit your completed project!

A jury consisting of your peers will judge project submissions!

In the Comments Below Let Us Know Your Ideas for Projects Around Photonics!

obstacle detection | nick holonyak jr | photodiodes | time of flight camera | red led | light-emitting diodes | precision agriculture | photoconductive camera tubes | optical fiber communication | shuji nakamura | industrial robot | radiative recombination | object detection | injection laser diodes | photoresistors | phototransistors | advanced driver assistance systems | security systems | lidar | photonics | artificial intelligence | classification tracking | ir beam | drone | blind spot detection | autonomous vehicles | optocoupler | collision avoidance | light amplification by stimulated emission of radiation | oleds | time-of-flight | photonicsch | electromagnetic radiation | photoemissive camera tube | terahertz quantum cascade lasers | quantum cascade lasers | vr | charge-coupled imaging devices | adas | leds | photoconductivity | green led | adaptive cruise control | visual instrumentation | phototransistor | photon | electric eye | infra-red detectors | ioc | photoelectric | heinrich hertz | photomultipliers optoisolators | stimulated emission | maser | lane keeping | light beam | gan | integrated optical circuit | john n. shive | james clerk maxwell | identification tracking | augmented reality | laser | parking assistance | lighting control | solar cells | john bardeen | max planck | endoscopy | photovoltaic effect | gallium nitride | william shockley

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Top Comments

dubbie *over 5 years ago* +3
This looks fun. Not sure what I could do though, however, I do have a small laser pointer of the type used for cat toys, it is surprisingly good. Maybe I could do something with that. Dubbie

tariq.ahmad *over 5 years ago in reply to dubbie* +2
Hi dubbie , A while ago we did a Cool LED Display competition and any of those LED projects could be inspiration for a Photonics project as well. Also could look back to Merry Boxes & LEDs for inspiration…

koudelad *over 5 years ago* +2
I have a simple, but useful idea - our electric boiler is set to turn on when there is a low price electricity rate. Low / high rate is controlled remotely by an electricity company. I don't know the specifics…

Oldest | Best | Newest

dubbie *over 5 years ago*
This looks fun. Not sure what I could do though, however, I do have a small laser pointer of the type used for cat toys, it is surprisingly good. Maybe I could do something with that.

Dubbie

+3 Like 1 Reply More

tariq.ahmad *over 5 years ago in reply to dubbie*
Hi dubbie ,

A while ago we did a Cool LED Display competition and any of those LED projects could be inspiration for a Photonics project as well. Also could look back to Merry Boxes & LEDs for inspiration.

This project broadly focuses on Photonics and when you think of how broad this category is it should provide a lot of options.

+2 Like 1 Reply More

dubbie *over 5 years ago in reply to tariq.ahmad*
I will have to look up the Cool LED Display project. Or just have a good think and see what I might be able to come up with. I'm sure there must a good idea lurking in my mind somewhere.

Dubbie

0 Like 1 Reply More

sanyaade *over 5 years ago in reply to dubbie*
dubbie Dubbie :

I also will look up for some LiDar, LED and Laser kits that I may have at home to see if a mini-project can be quickly stood within then time-frame

LiDar and Laser are getting cheaper nowadays so I could go that way or do something around modulation with lights.

Cool stuff!

God blesses!!!

Best regards,
Sanyaade

+1 Like 1 Reply More

dubbie *over 5 years ago in reply to sanyaade*
Yes, lots of possibilities. I look forward to seeing yours as well as others, and hopefully, maybe even putting something together myself. I a small laser pen, just not yet sure what to do with it.

Dubbie

0 Like 1 Reply More

koudelad *over 5 years ago*
I have a simple, but useful idea - our electric boiler is set to turn on when there is a low price electricity rate. Low / high rate is controlled remotely by an electricity company. I don't know the specifics of this remote control, but one of the outputs is an LED that lights on the electric boiler when the low rate is ON. I could get some black tube to shield the LED from the ambient light and sense this LED by a photo-resistor / photo transistor. I could then save the information in a database which I use to store various sensor measurements. The output of this would be a calculation of the total low / high rate and checking the plans of the distribution company.

Any ideas how to do this simple application low power? I don't have any experience with wireless transmission. I would need something that could be later easily integrated into my raspberry pi server running node-red and influxdb.

WiFi probably consumes too much, but the transmission and reception would be the easiest. (Or not? If turned on only for transmission for a few seconds every 5 or ten minutes?) Bluetooth and other will require implementing some custom protocol...

+2 Like 1 Reply More

abiswas1993 *over 5 years ago*
Hi Everyone,

Here is my photonics idea-

Title: WaterSpectra

Description: Water pollution and contamination is an important factor for determining safe drinking water. In this project I will try to determine the water contamination level by observing a light spectrum which will be transmitted through the water. I have to analyze the optical spectrum with a spectrometer and use a broadband light source (a deuterium arc lamp) to generate the broadband light source. This method should detect water contamination in optical spectrum (250nm -1100 nm).

This should be fun. Please let me know about your thoughts.

+1 Like 1 Reply More

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