



PHOTONICS: ONE OF THE KEY DRIVERS OF THE 21ST CENTURY MAKING THE WORLD SMART

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| Article history: | Abstract: |
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| Received: 7 th April 2021 Accepted: 24 th April 2021 Published: 17 th May 2021 | This research paper aims at presenting new devices concepts and to introduce novel photonic devices developed over the past years that are bringing innovation in our daily lives. It emphasizes the role of the photonic devices such as LASERs, LEDs etc. in the different communication systems. It also shows how significant advancements have been made in the field of photonics for the betterment of the human beings. The use of the photonic devices is increasing significantly over the years as it has many applications in the field of the information broadcasting and telecommunications. So, in this way these photonic devices are bringing innovation to our daily lives. |

Keywords: Light amplification by stimulated emission of radiation (LASER), Light emitting diodes (LEDs)

1. INTRODUCTION

Light is the electromagnetic radiation in the electromagnetic spectrum that human eye can perceive. It not only brightens our darkness but also have many uses that impact our life. Maxwell resulted that light has electromagnetic nature. Light travels in vacuum at constant speed. This speed of light is considered to be universal constant. Light is a form of energy that can be transferred or converted to other forms of energy. Hence it can be used to carry message from one place to other.

The electromagnetic spectrum is the range of all possible frequencies of radiation. The spectrum is generally divided into seven regions in order of decreasing wavelength or increasing energy and frequency. It consists of radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays and gamma-rays. Our eyes respond differently to different wavelengths so we have different names for different regions of visible wavelengths. Visible region is the only region which human eye can detect. It consists of following colors red, orange, yellow, green, blue, indigo and violet.

The smallest discrete amount of electromagnetic radiation is Photon. It is the fundamental particle of light. Photons are the most visible portion of the electromagnetic spectrum. Photons are always in motion that is the reason they have zero rest mass. It carries energy and momentum. Photon has spin +1. So, photon is boson.

Photonics comes from the word 'photon' which is the smallest unit of light. Photonics is the generation, manipulation, transmission, amplification, detection and use of light. Photonics includes all technologies that use light, create light or modify light. Using light to make electricity such as in photovoltaic solar panels, creating light using electricity such as LED technologies and modifying light such as in LASER is all what happens in the field of photonics. Photonics uses the photon in the same way as the electronics uses the electron. In electronics we use electrons to push through circuits and similarly in photonics we use photons which are quantized form of light. There is big need to make things faster, less energy, smaller and more cheaply. Replacing electrons with photons does all that. Hence photonics is the science and application of light. It is true that electronic devices have been replaced by the photonic devices due to the tremendous benefits of the photonics

Photonic devices are components for creating, manipulating or detecting light . LASERs, Light emitted diode (LEDs), optical amplifiers, solar and photo-voltaic cells, optical sensors and photo-detectors are the examples of the photonic devices.

2. ROLE OF PHOTONICS / FEATURES OF PHOTONICS

This is an era of technology. Photonics is considered to be key drivers for the 21st century. This is supported by the fact that since 2000 more than 20 Nobel Prizes have been awarded for photonics and photonics related researches. With the invention of the LASER in 1960 and the optical fibers in 1970s, the science of photonics emerged and took a giant leap forward. Today, when we think about the things around us, that's all the applications of the photonics. We can list the things as optical fiber communications, light emitted diodes (LEDs), the cameras we use in our mobile phones, the solar energy that we are getting from the solar cells are all the applications of the photonics. Nowadays detecting, propulsion and exchange of information has become very advance.

Photonics is upcoming trend of creation that has assured to be better and made our lives optimal and smart. Photonics is considered as one of the key technologies of the 21st century. There are a number of applications that are emerging for complex silicon photonic systems. The most important application of the silicon photonics is its use in data communication. Today, the area of photonics application is growing at an incredible rate. Without photonics it will be impossible to have E-mail, Google, Facebook and YouTube. It also will be impossible to transfer pictures, music and video to the way we do it today

3.APPLICATIONS OF PHOTONICS

Photonics is playing vital role by bringing innovation not only in the fields of data communication but also in several sectors. From the optical data communication to imaging, displays and lighting to energy generation, healthcare sector to public security and safety, photonics is widely used. Photonics is making traffic growth, fast network changes and varying traffic demands. On the other hand photonics is making data communications faster, cheaper and less energy consuming.

DVD (digital video disk) player use LASER light to read what is on the disk. Photovoltaic is the technology of converting light into electricity. Solar panels can be seen in many places today on rooftops of houses and businesses are the examples of the photonics devices. Products that emit light such as cinema projectors, television's screens, heads-up displays in cars, the display of our phones or GPS (global positioning system) and a camera captures light, all are photonics technologies.

Photonic devices are used in cutting-edge by using LASER, fiber-optics, manufacturing, health care, telecommunication, environmental monitoring, homeland security, aerospace, solid state lighting, and many others. Photonics is widely used in telecommunication industry. Optical amplifiers, photo-detectors, optical modulators, photonic integrated circuits (PICs) are the examples of the photonic devices used in communication system.

High precision sensing devices are the example of the optical sensors. The military relies heavily on the optical spectrum for sensing, mapping and identifying enemy intent over large distances. If we talk about the use of photonic devices in medical field, Bio-photonics is a new and rapidly growing discipline in the health care sector. It studies the interaction between light and human tissue

4.FUTURE OF PHOTONICS

Photonics is our future just because of the fact that light travels faster than electricity. It is just because of the photonics, Internet is affordable and accessible around the world. So far, photonics has achieved a deep penetration of mass markets and correspondingly large sales volumes in only a few areas, e.g. laser diodes in CD/DVD players and related techniques of optical data storage. Huge growth opportunities are expected from the development of silicon photonics and other technologies for example photonic integrated circuits (PICs). Photonic integrated circuits (PICs) are optically active integrated semiconductor photonic devices. Photonic integration is a technology that has proven its maturity on telecom and data communication markets, and is now being extended to other fields like sensing, medical and life sciences applications.

Photonics is addressing and solving challenges of the modern world. Businesses in the field of photonics and light-based technologies work on solving key challenges of the modern world, such as energy generation and energy efficiency, healthy ageing of the population, climate change, and security.

5.CONCLUSION

Today, with the help of photonics, the hard work has been replaced with smart work. It is true that electronic devices have been replaced by the photonic devices due to the tremendous benefits of the photonics. Photonic devices like lasers and LEDs are efficient and inexpensive. They are also environment friendly. These photonics devices are applied in science, engineering, medicine and commerce. In the future, output of the photonic devices will continue to increase significantly.

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