Assignment 05

Student name: *Mélina Sladic, Lukas Probst*
Legi number: *XX-XXX-XXX, 22-714-240*

Course: *Wireless Networking and Mobile Computing* – Lecturer: *Dr. Mangold*
Due date: *November 28th, 2022*

Step 2: Theory

What is the bandwidth of the optical spectrum (measured in Hz)?

The visible spectrum, sometimes referred to as opical spectrum, corresponds to a band in the vicinity of 400–789 THz [4].

Is the visible spectrum regulated?

Yes, the FCC[1] is responsible for managing and licensing the electromagnetic spectrum for commercial users and for non-commercial users including: state, county and local governments.

What is the difference between infrared and visible light?

Visible light has a wavelength that ranges from 380 nm to 750 nm on the electromagnetic spectrum while infrared light is beyond it, ranging from 700 nm to 1 mm, the beginning of the non-visible portion of the spectrum. As a result, infrared light cannot be seen by the human eye except with special technical equipment.

[1] https://www.fcc.gov/licensing

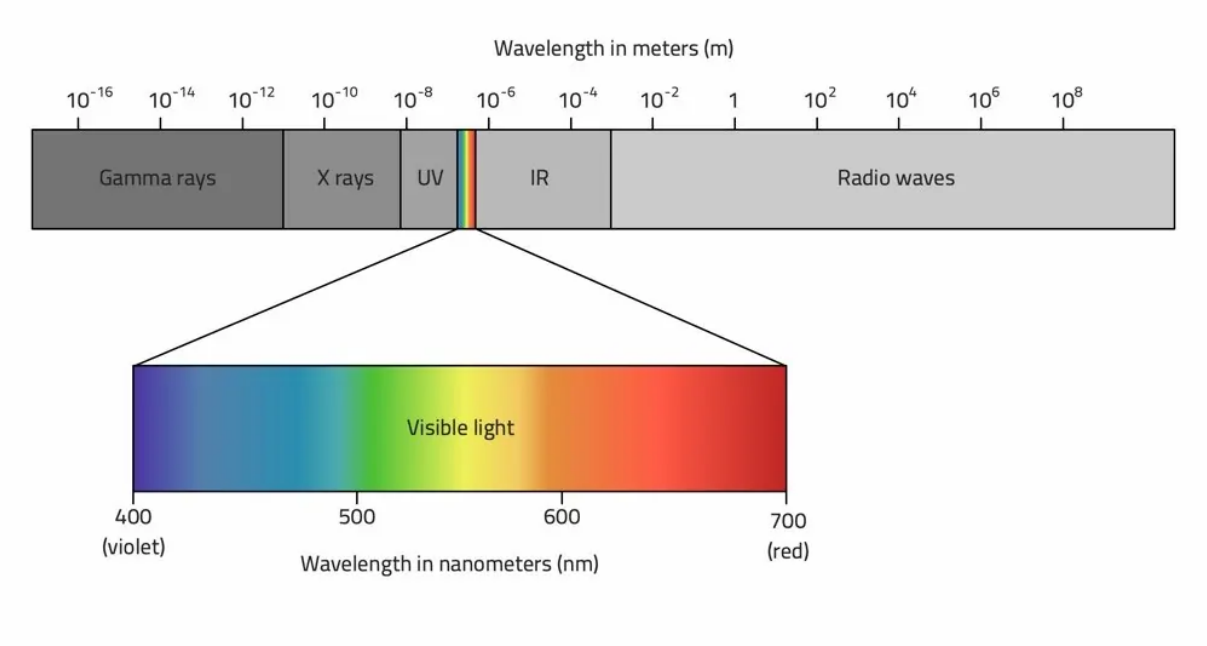

Figure 1: Components of the electromagnetic spectrum.

.

Can infrared light penetrate water? Can visible light?

Light penetrating a water surface is scattered and absorbed as it passes downward. Infrared light is absorbed by water more strongly than visible light. Water absorbs infrared light quickly and only little infrared light penetrates more than 2 m. Within the first 10 m, water absorbs more than 50 percent of the total visible light energy. Hence, light is obliterated rather quickly even in clear water. Only about 25 percent of incident light reaches a depth of 10 m in the open ocean, where water is very clear [1].

What are the benefits of using an LED instead of a photodiode as a receiver in consumer electronics?

Using an LED as a receiver in consumer electronics enables low bitrate wireless ad-hoc networking [3].d To transmit and receive, an LED can be connected directly to the microcontroller's pins. If a photodiode is utilized for receiving, it must either be connected directly to one of the analog pins on the microcontroller (where it is then sampled by the firmware of the controller) or it can be routed through an amplifier first [2]. Therefore, it is easier to use a LED instead of a photodiode as a receiver.

Step 3: Arduino - PC Communication

Step 4: Chat Application

Step 5: Performance Measurement at different Distances, find out the Maximum Range)

References

[1] *Light in the Ocean | manoa.hawaii.edu/ExploringOurFluidEarth*. [Online; accessed 22. Nov. 2022]. Nov. 2022. URL: https://manoa.hawaii.edu/exploringourfluidearth/physical/ocean-depths/light-ocean.

[2] Stefan Schmid et al. "EnLighting: An Indoor Visible Light Communication System Based on Networked Light Bulbs". In: *2016 13th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON)*. 2016, pp. 1–9. DOI: 10.1109/SAHCN.2016.7732989.

[3] Stefan Schmid et al. "LED-to-LED Visible Light Communication Networks". In: *Proceedings of the Fourteenth ACM International Symposium on Mobile Ad Hoc Networking and Computing*. MobiHoc '13. Bangalore, India: Association for Computing Machinery, 2013, pp. 1–10. ISBN: 9781450321938. DOI: 10.1145/2491288.2491293. URL: https://doi.org/10.1145/2491288.2491293.

[4] Stefan M. Schmid. "Software-Defined Low-Complex Visible Light Communication Networks". en. Doctoral Thesis. Zürich: ETH Zurich, 2016. DOI: 10.3929/ethz-a-010811920.