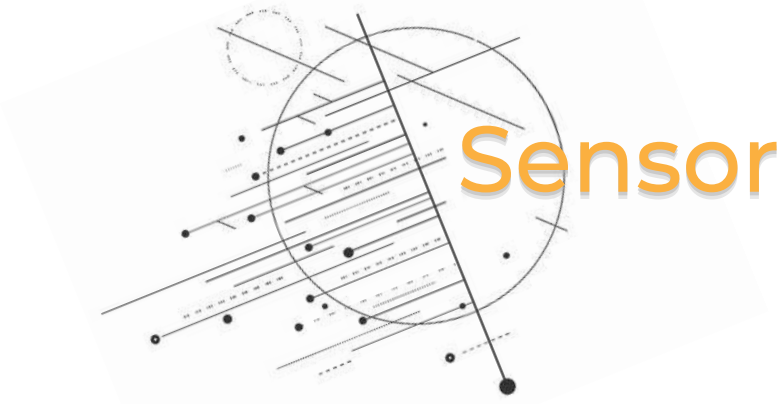


Sensor Starters

Grades: 4 & Up
Time: 15 Minutes -PDQ 1 & 2

Subject: Physics, Technology, STEM
Topics: Ultraviolet Radiation, UV index, Wavelength

Meet the UV Sensor!

The UV sensor senses Ultraviolet (UV) light wavelengths in the sunlight. If you're out running in the sun, this sensor can warn you if the UV index is dangerously high and you need to seek cover! This sensor is used in a variety of devices such as wearables (smartwatches & smart bands), hand-held UV meters, medical equipment, weather stations, and more.

Background

databot's UV Sensor measures UV wavelengths and calculates the UV index, a standardized rating for ultraviolet radiation intensity. UV is different from visible light. UV has longer wavelengths and is invisible to the human eye. The electromagnetic spectrum is comprised of many wavelengths of radiation. The visible, ultraviolet, and infrared light subset of the spectrum is shown here.

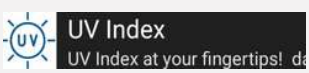


UV radiation is harmful to human health and can cause skin cancer, skin damage, eye damage, and even immune system suppression. For this reason the UV index is published daily and you can use it as a guide to dress and prepare appropriately.

Using sunscreen is one way to protect yourself from UV radiation. Sunscreen is rated by Sun Protection Factor (SPF) which rates the amount of protection. The higher the SPF number, the better your protection, so SPF 10 is not as strong as SPF 50. Note: the SPF scale does not relate to time in the sun, a common misconception.

What You Will Need/Prep

- databot™ & Vizeey™
- IOS/Android Smart Device
- Use Vizeey to scan the QR Code for UV Index.





The UV sensor is a white rectangular chip with a circle inside it. Look closely near the rear power port for the UV label and you will see it!

Sensor Starters

Important Terms

Electromagnetic Spectrum: The range of all types of EM radiation. Radiation is energy that travels and spreads out as it goes – the visible light that comes from a lamp in your house and the radio waves that come from a radio station are two types of electromagnetic radiation.

Radiation: Is energy that comes from a source and travels through space at the speed of light. This energy has an electric field and a magnetic field associated with it, and has wave-like properties. You could also call radiation "electromagnetic waves.

Sun Protection Factor (SPF): A measure of how well a sunscreen will protect skin from UVB rays, the kind of radiation that causes sunburn, damages skin, and can contribute to skin cancer.

Sunscreen: A photoprotective topical product for the skin that helps protect against sunburn and most importantly prevent skin cancer.

Ultraviolet (UV): UV light waves are tiny - 200-400 nanometers. A nanometer is one billionth of a meter (that's pretty small).

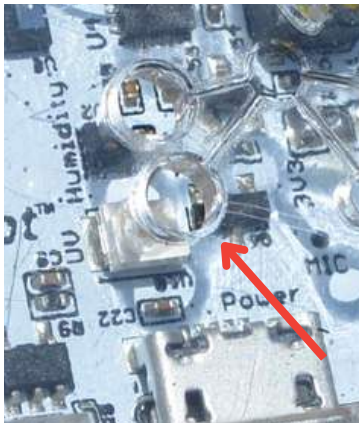
UV Index: A global solar scale that rates ultraviolet radiation intensity. People use this scale to prepare against sunburn.

Wavelength: Electromagnetic radiation like radio waves, visible light, or UV travels in waves with certain shape and length. The distance between peaks (high points) is called wavelength.

How do we measure the UV Index?

The Global Solar UV Index represents the amount of skin-damaging UV radiation being delivered at any time. This scale is used to inform you of UV levels so you can prepare for outdoor exposure.

Category	Index	Sun Protection Recommendations
Low	1 - 2	Wear sunglasses if bright; cover up; sunscreen.
Moderate	3 - 5	Cover up; sunscreen; stay in shade at midday.
High	6 - 7	Sunburn protection required; full cover & sunscreen.
Very High	8 - 10	Avoid sun between 11-4; full cover & sunscreen.
Extreme	11+	Unprotected skin burns in minutes. Highest protection.



Exploration Preparation!

Look for the opening in the plastic over the UV sensor. This allows the passage of UV wavelengths as databot's polycarbonate case has natural UV blocking characteristics. You will use this opening in the upcoming PDQ to get a pure UV index reading. Look for it!

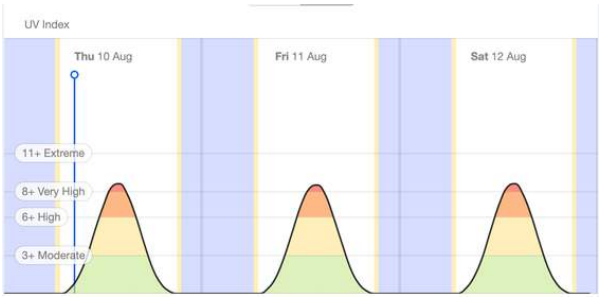
Sensor Starters

PDQ1 : Shadow Sight

Using the databot UV sensor it is possible to find the UV index in your city! Find the UV index by experimenting with databot in sunlight and comparing it with the UV index published in the weather report. Are you being exposed to a safe or unsafe level of UV light?

- To find the **UV Index** for your present location, you can look up your local weather conditions on the internet. We used UV Index and our current city in the search.
- Open Vizeey on your smart device.
- Turn on databot.
- Tap on "**UV Index**" *i*n Vizeey to load the experiment.
- Position databot so you can see the shadow of a circle on the sensor board known as the "shadow sight" - it is projected on the board by the hole in the plastic cover.
- Rotate and move databot until you get the sight precisely centered on the UV sensor and note the UV index in the sunlight.
- Start and pause your experiments using :
- Compare your findings with the UV Index published in the weather report and determine if you are being exposed to an unsafe level of UV.
- If so, how can you protect yourself from UV damage?

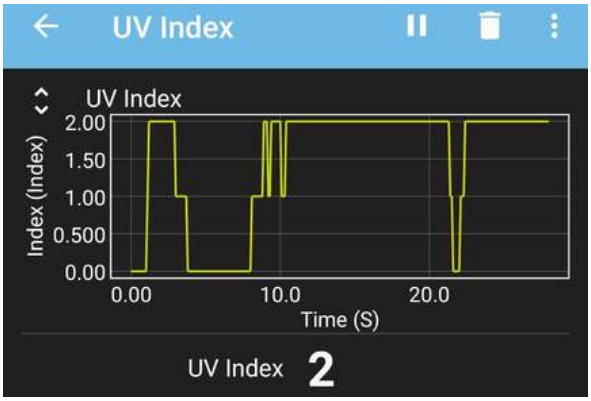
Example of UV index published in a weather report.





Shadow Sight

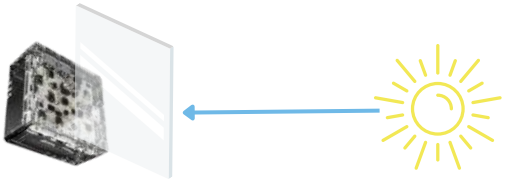
Example of UV Index Reading



Sensor Starters

PDQ2 : Step Aside, Let the UV Through!

Using databot it is possible to experiment with UV/Ultraviolet light. Identify a transparent material that cuts down your UV Index by 50% or more. Be precise in your language and your data collection as you explore this challenge. Good luck.



Example of material placed as an obstacle between databot™ and the sunlight.

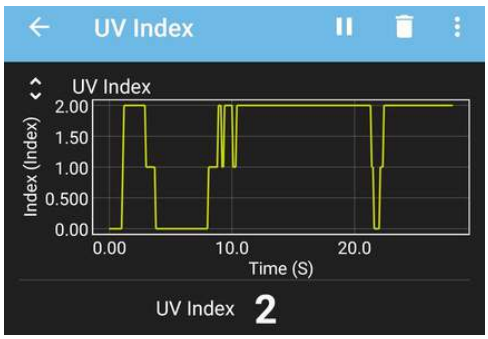
- Open Vizeey on your smart device.
- Turn on databot.
- Tap on "**UV Index**" *i*n Vizeey to load the experiment.
- Start and pause your experiments using :
- Using your newly mastered shadow sight skills capture the UV index.

- Place any transparent material like plastic, plastic wrap, glass, or other items in front of databot as an obstacle.
  - Repeat the same procedure and try different items until you find a drop in the UV index.

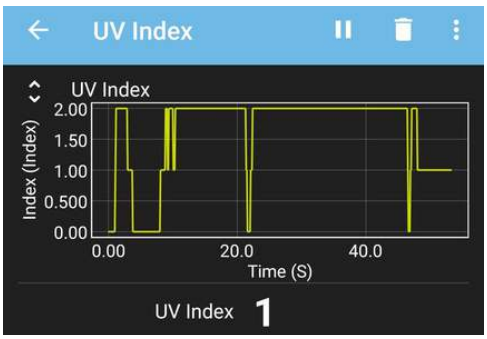
- Record the UV index value and the material that cuts down the index by 50% or more.

What materials would cut the UV index value down even more. Experiment and find out!

Material	UV Level



Before placing an obstacle



After placing an obstacle

Check for Understanding

1. What is the electromagnetic spectrum? Give three examples of wavelengths from the spectrum.
2. Why is Ultraviolet radiation dangerous?
3. What is the UV index and where can you check for UV levels daily to protect yourself and your family from harmful exposure levels?

Standards & Alignment

NGSS Standards

- Waves and their Applications in Technologies for Information Transfer: HS-PS4-3
- Earth and Human Activity: HS-ESS3-5
- Engineering Design: HS-ETS1-3
- Energy: (HS-PS3-1) (HS-PS3-3)
- Earth's Place in the Universe: HS-ESS1-1

Disciplinary Core Ideas

- PS4.A: Wave Properties (Physical Sciences)
- LS1.D: Information Processing (Life Sciences)
- ESS3.D: Global Climate Change (Earth and Space Sciences)
- PS1.A: Structure and Properties of Matter (Physical Sciences)
- LS3.A: Inheritance of Traits (Life Sciences)
- ESS2.D: Weather and Climate (Earth and Space Sciences)
- ETS1.B: Developing Possible Solutions (Engineering, Technology, and Applications of Science)
- ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World (Engineering, Technology, and Applications of Science)

Crosscutting Concepts

- Patterns
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter: Flows, cycles, and conservation
- Structure and function
- Patterns and Variability

ISTE Standards

- 1.1 Empowered Learner (1.1.c)
- 1.2 Digital Citizen (1.2.c)
- 1.3 Knowledge Constructor (1.3.c)
- 1.4 Innovative Designer (1.4.a)(1.4.b)
- 1.5 Computational Thinker (1.5.a) (1.5.b)
- 1.6 Creative Communicator (1.6.a) (1.6.b)
- Global Collaborator (1.7.d)

Science and Engineering Practices

- 1st Practice: Asking Questions and Defining Problems
- 3rd Practice: Planning and Carrying Out Investigations
- 4th Practice: Analyzing and Interpreting Data
- 5th Practice: Using Mathematics and Computational Thinking
- 6th Practice: Constructing Explanations and Designing Solutions
- 7th Practice: Engaging in Argument from Evidence
- 8th Practice: Obtaining, Evaluating, and Communicating Information

Standards & Alignment

TEKS -Texas Essential Knowledge and Skills

Elementary Process TEKS

5.2C Scientific investigation and Reasoning: Collect and record information

5.2D Scientific investigation and Reasoning: Analyze and interpret information to construct reasonable explanations.

Elementary Level Content TEKS

5.6C Force, Motion and Energy: Demonstrate how light travels

High School Level Process TEKS

P.2J Scientific Investigation and Reasoning: Express relationships among physical variables quantitatively, including the use of graphs, charts, and equations.

P.2F: Scientific Investigation and Reasoning: Collect and organize qualitative and quantitative data and make measurements with accuracy and precision, using tools such as data collecting probes.

High School Level Content TEKS

P.8A Physics: Describe the dual nature of light.