



HELLAS

**Panhellenic Educational Robotics Contest 2023**

**Open Junior High School Category**



## **Light Pollution**

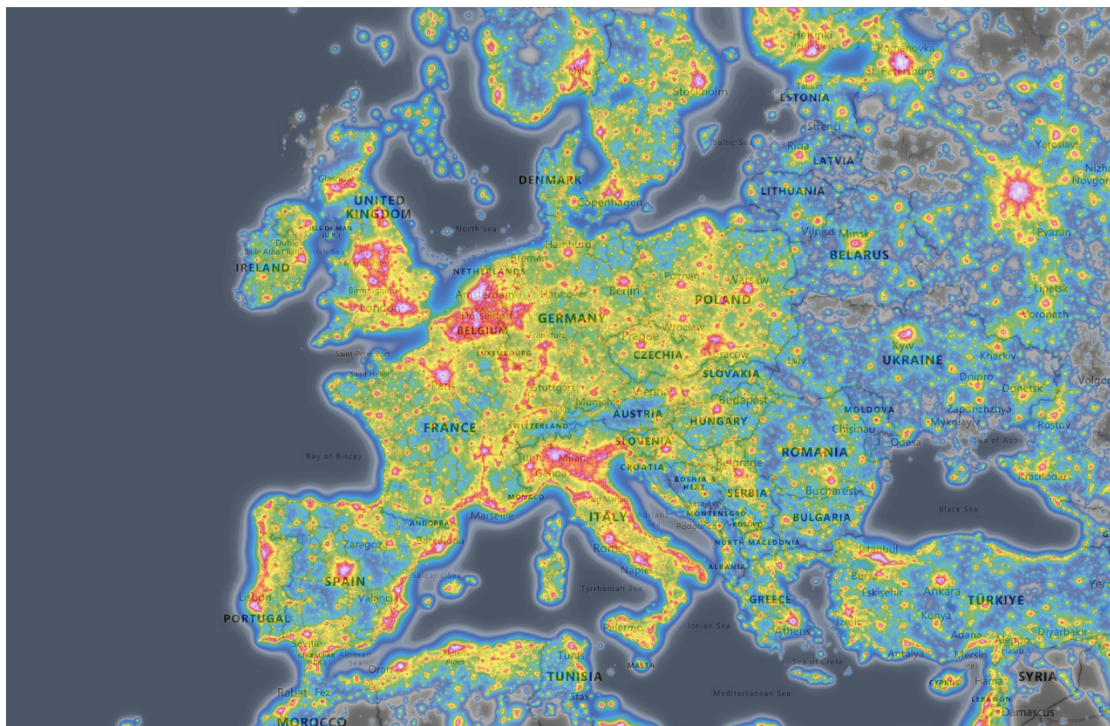
Create your own **robotic solution** that will study, measure and propose solutions to the problem of light pollution.

## Introduction

Most environmental pollution on Earth comes from humans and their inventions. Take, for example, the car or this miraculous man-made material, plastic. Today, car emissions are a major source of air pollution that contributes to climate change, and plastics fill our ocean, posing a significant risk to the health of marine animals.

And what about the electric light bulb, believed to be one of the greatest human inventions of all time? Electric light can be a beautiful thing, lead us home when the sun goes down, keep us safe and make our homes comfortable and bright. However, like carbon dioxide emissions and plastic, this has begun to negatively affect the environment. Light pollution, the excessive or improper use of artificial outdoor light, affects human health, wildlife behavior and our ability to observe stars and other celestial objects.

### The glow of the Earthly Sky



Light pollution is a global issue. This was made abundantly clear when the World Atlas of Brightness of the Night Sky, a computer-generated map based on thousands of satellite photos, was published in 2016. Available online for viewing, the Atlas shows how and where our globe is illuminated at night. Vast areas of North America, Europe, the Middle East and Asia shine with light, while only the most remote regions on Earth (Siberia, Sahara and the Amazon) are in complete darkness. Some of the most light-polluted countries in the world are Singapore, Qatar and Kuwait.

The glow of the sky is the glow of the night sky, mainly in urban areas, due to the electric lights of cars, lamps, offices, factories, outdoor advertising and buildings, turning night into day for people who work and play long after sunset.

People living in cities with high levels of sky glow find it difficult to see more than a handful of stars at night. Astronomers are especially interested in the pollution of the sky, as it reduces their ability to see celestial objects.

More than 80 percent of the world's population, and 99 percent of Americans and Europeans, live under the glow of the sky. It sounds beautiful, but the glow of the sky caused by anthropogenic activities is one of the most diffuse forms of light pollution.

### **Is it time to get up?**

Artificial light can wreak havoc on the body's natural rhythms in both humans and animals. Night light interrupts sleep and confuses circadian rhythm - the internal, round-the-clock clock that guides day and night activities and affects physiological processes in almost all living organisms. One of these processes is the production of the hormone melatonin, which is released when it is dark and inhibited when there is light. The increased amount of light at night reduces the production of melatonin, which leads to sleep deprivation, fatigue, headaches, stress, anxiety and other health problems. Recent studies also show a link between decreased melatonin levels and cancer. In fact, new scientific discoveries about the health effects of artificial light have convinced the American Medical Association (AMA) to support efforts to control light pollution and conduct research into the potential dangers of exposure to light at night. Blue light, in particular, has been shown to reduce melatonin levels in humans. Blue light is found in mobile phones and other computer devices, as well as in light-emitting diodes (LEDs), the kinds of lamps that have become popular in the home, and in industrial and city lighting due to their low cost and energy efficiency.

### **Animals are also lost and confused**

Studies show that light pollution also influences animal behaviors, such as migration patterns, awake sleep patterns, and habitat formation. Due to light pollution, sea turtles and birds guided by moonlight during migration get confused, lose their way and often die. A large number of insects, the main source of food for birds and other animals, are attracted to artificial lights and are immediately killed when they come into contact with light sources. Birds are also affected by this, and many cities have adopted a program "Lights Out" to turn off the lights of the building during the migration of birds.

A study on blackbirds (*Turdus merula*) in Germany found that traffic noise and artificial night lighting force birds in the city to be active earlier than birds in natural areas - waking up and singing up to five hours earlier than their cousins. Even animals living under the sea can be affected by underwater artificial lighting. One study looked at how marine animals responded to brightly lit panels submerged under water off the coast of Wales. Fewer pot-nosed animals, such as sea squirt and sea hair, built their homes near the illuminated panels. This could mean that light from oil rigs, passing ships and ports is changing marine ecosystems.

Even in places meant to provide protected natural habitats for wildlife, light pollution has an impact. The National Park Service (NPS) has made it a priority to maintain a dark night sky.

**The contest's theme**

Create your own robotic solution that will study, measure and propose solutions to the problem of light pollution.

## **Participants**

- Age of students: 1st – 3rd high school (12-14 years old)
- Group composition: 2-4 students

## **Rules**

The teams are asked to create a robotic solution related to the topic, according to the following rules:

- Your solution may consist of one or more sensors, motors and mechanisms that will be controlled by one (1) controller
- There is no restriction on which sensor, motor or controller you will use.
- You can use any environment and programming language you want.
- Each team on the day of the contest can present their work in a space that will be indicated to them, measuring 1.5 x 1.5m. Any decorative elements of the project (posters, banners, etc.) should be integrated in this space.
- The presentation of the work concerns both the judges and the guests, competitors and each team should be able to present their work to everyone
- The use of dangerous materials such as fire, toxic and dangerous gases, high voltage current, etc. is prohibited.

## **Before the day of the contest**

Each team, up to 10 days before the contest, must have delivered a portfolio in electronic format (in the form of a link) that will include a video of a maximum duration of 1.5 min (brief presentation of the team, the robotic system and the solutions to the problem, snippets of the system in action, etc.), instructions for building the system and its code.

## **The contest's procedure**

The teams will come to the pitch on the day and time announced by WROHellas. They will be shown a space where they can install their equipment and robotic system. They will have time at their disposal for this process, while each team will have been notified at least 10 minutes before the arrival of the panel of judges so that they have prepared properly.

## **Evaluation**

Each team will have 6 minutes to present their work to the judges and be scored. Specifically, 3 minutes to demonstrate the robotic system and 3 minutes to answer questions from the judges.

The evaluation of each team is done according to the international standards set by the WRO Educational Robotics Olympiad, as shown in the evaluation table below.

	<b>Criterion</b>	<b>Score</b>	<b>Maximum score</b>
<b>Work &amp; Innovation</b>	Idea, Quality and Creativity		<b>30</b>
	Research and Reporting		<b>15</b>
	Usefulness of the idea		<b>15</b>
	Innovation and Slogan		<b>10</b>
	Total		70

	<b>Criterion</b>	<b>Score</b>	<b>Maximum score</b>
<b>Robotics Solution</b>	Robotic Solution		<b>30</b>
	Meaningful use of engineering concepts		<b>10</b>
	Code efficiency & software automation		<b>10</b>
	Presentation of Robotic Solution		<b>15</b>
	Total		65

	<b>Criterion</b>	<b>Score</b>	<b>Maximum score</b>
<b>Presentation &amp; Team Spirit</b>	Presentation & Presense		<b>30</b>
	Technical understanding and quick thinking		<b>15</b>
	Team Spirit		<b>20</b>
	Total		65