Judging Form

Region: 2 **Entry #:** 4725B

Title: S.T.A.R. Sea Turtle [redacted] Assistance Rod

Entry Level:

(K-3) 4-6 7-9 10-12

S.T.A.R

Sea Turtle Assistance Rod

ABSTRACT

A mother sea turtle will come onto the beach, usually at night, to lay her eggs. She lays her eggs in a nest that she covers with sand for protection, and then she returns to the sea. Turtle hatchlings must find their way to the ocean. They are often distracted by the bright lights from houses and hotels on the beach. This causes them to go in the wrong direction. Because of this and other challenges posed by predators, only one in one thousand hatchlings will survive to adulthood!

Our S.T.A.R. technology of the future tackles this problem by using sea turtle "rescue packs" that will protect nests, maintain safe temperatures for turtle eggs and provide a guide for turtle hatchlings to reach the ocean safely. Night vision cameras, temperature and motion sensors, and solar cells will help to keep sea turtle hatchlings safe as they journey to the sea.

S.T.A.R.

(Sea Turtle Assistant Rod)

DESCRIPTION

Present Technology

A mother sea turtle will come onto the beach, usually at night, to lay her eggs. She lays her eggs in a nest that she covers with sand for protection, and then she returns to the sea. Turtle nests must maintain a certain temperature (84.2^0 F) to produce equal male and female turtles. If the temperature of the nest is too high, too many females will be produced. If the temperature of the nest is cooler, too many male turtles will be produced. Turtle hatchlings begin to appear in six to eight weeks. They must find their way to the ocean. They are often distracted by the bright lights from houses and hotels on the beach. This causes them to go in the wrong direction. Because of this and other challenges posed by predators, only one in one thousand hatchlings will survive to adulthood!

Our technology of the future will address this problem by using sea turtle "rescue packs" that will protect nests, maintain safe temperatures for turtle eggs and provide a guide for turtle hatchlings to reach the ocean safely. Night vision cameras, temperature and motion sensors, and solar cells will help to keep sea turtle hatchlings safe as they journey to the sea.

Sensors

A sensor is a tool that is programed to gather information from the environment. This information is called input. Once the information is gathered, the sensor turns the information into some action. This is called output. Sensors measure the information that they are programed for and show it in a way that can be recognized. Sensors are used for many different purposes such as detecting temperature, motion, electrical current, light, vibration, distance, safety, as well as for medical purposes and industry and classrooms.

Temperature Sensors

A temperature sensor works by measuring the difference in electricity between different types of metal. Because the metals are different, they heat up or cool down at different speeds.

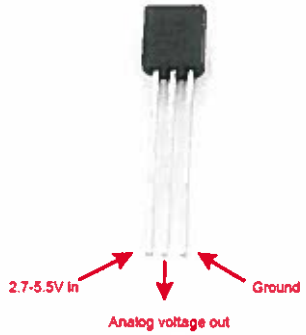


Photo credit: http://www.instructables.com/id/Temperature-Sensor-Tutorial/?ALLSTEPS

An analog temperature sensor is one of the easiest to use. They do not use mercury, metal strips or resistors. These types of temperature sensors do not cost much, and they work in many environments.

Motion Sensor

Passive infrared motion detector: This sensor reacts to rapid change in "infrared radiation (IR)" caused by the energy of body heat. Crystal-like structures on the surface of the motion detector create an electric charge when heated by the turtle's body heat. As radiation increases, the electrical charge increases, and the sensor reacts to the change in environment by sending a signal. This is the type of motion detector that will be used in the S.T.A.R. technology.

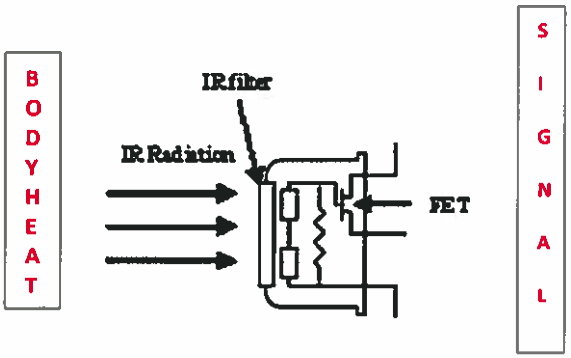


Photo credit: www.google.com/images and student add-on

Night Vision Camera

Night vision cameras are used to see in the dark using infrared technology. They can be used through dust and smoke also. Night vision cameras that use thermal imaging can sense the infrared wavelength of light released by warm objects and convert it to a visual image.

Photo credit: www.google.com/images

Solar Energy/ Cells

A solar cell works by the power of the sun. When sunlight (photons) hit the electrons in a semiconductor it causes the electrons to move to a higher energy and the other electrons move in to take their place. This movement of electrons creates electricity. Solar cells are used in a wide variety of technologies from calculators to solar arrays on the International Space Station!

History

Sensors have been in use since the 1880's. The first **thermostat** was invented by Warren S. Johnson in 1883. The first **motion sensors** were available around 1950 as part of a security system. Sensor technology keeps on growing as the need occurs.

Research into **night vision cameras** started in the 1940's, mostly for use by the military. The US military first used night vision cameras in the Vietnam War. By the 1980's law enforcement officers and rescue teams had access to this technology. Today, night vision cameras are used by photographers, wildlife watchers, boaters, campers and many more.

Solar cells

Solar energy, or Light Energy, has been used as a source for heat and fire since the time of ancient Greek, Roman and Chinese cultures. The recent history of solar energy has been about using solar energy to make electricity for our houses and all the devices we have.

Recent Solar Energy Timeline:

1767 – A Swiss scientist created the first Solar Oven using a box with mirrors called a Solar Collector

1839 – A French scientist discovered the 'Photovoltaic Effect' which showed that electricity could be made from light using different metals (called 'electrodes') in a salt water mixture (called 'electrolye')

1873 – The use of a material called Selenium to make electricity was discovered. This was important because Selenium could convert light into electricity without heat, electrolytes or moving parts. Selenium would be important for future solar cells.

1893 – The first solar cell was made. Solar cells are electrical devices that convert energy of light directly into electricity.

1908 – The copper collector was collected using copper and copper insulation to better turn sunlight into electricity that could be used for light. Many improvements would be made on the use of collectors and the use of materials to better capture sunlight and make it usable.

1958 – The first use of solar energy to make power for large objects was in space. Solar power was used for satellites and spaceships that were exploring outer space.

1960 and 1970s – Many people wanted to use solar energy for our houses and businesses. However, it was too expensive and the solar cells did not make enough electricity. A business called Exxon began making better solar cells and solar panels which made the solar energy easier to use.

1977 – The US government launched the Solar Research Institute.

1982 – Solar powered cars were invented in Australia using small solar panels

1986 – Large fields of solar panels were used to collect a lot of sunlight and generate large amounts of electicity. These are called solar 'power plants'

2000s - These first solar plants have gotten bigger and more efficient and now appear throughout the world helping to use the sun to make electricity without the pollution of other energy sources.

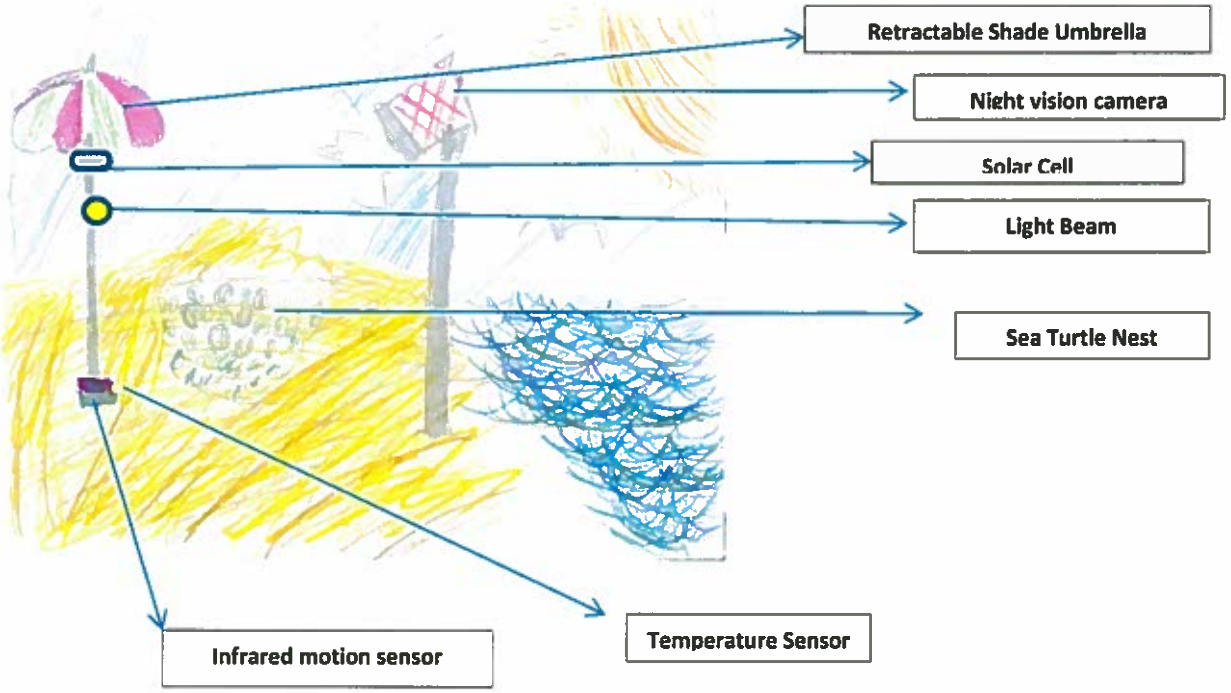
Future Technology

Our technology uses a night vision camera placed near the water on turtle breeding beaches. This will be used to track a mother turtle to her nest. Once a turtle nest is located, a "rescue pole" is placed in the sand at the location of the nest. The pole contains a temperature sensor, a retractable umbrella to provide shade, a motion sensor, and a light beam, all powered by a solar cell. The temperature sensor, located at the bottom of the pole, takes the temperature of the sand. When the temperature goes over 84.2^{0} F, the umbrella will emerge from the top of the pole and open up to provide shade. The shade will keep the nest cool and the umbrella will retract when the temperature returns to the normal 84.2^{0} F range. Nests that are too cold or too hot will affect the gender of the hatchlings, creating either too many males, or too many females.

The pole also contains a passive infrared motion sensor located at the base of the pole close to the eggs. The sensor reacts to a change in infrared energy detected through body heat. When the hatchlings hatch, the motion detector senses a change in infrared energy and activates a

light beam at the top of the pole. The light beam shines a bright light above the sand toward the ocean. The light mimics moonlight and leads the hatchlings to sea.

We believe that the S.T.A.R. technology of the future will provide the safety that the sea turtle hatchlings need to get to the sea!



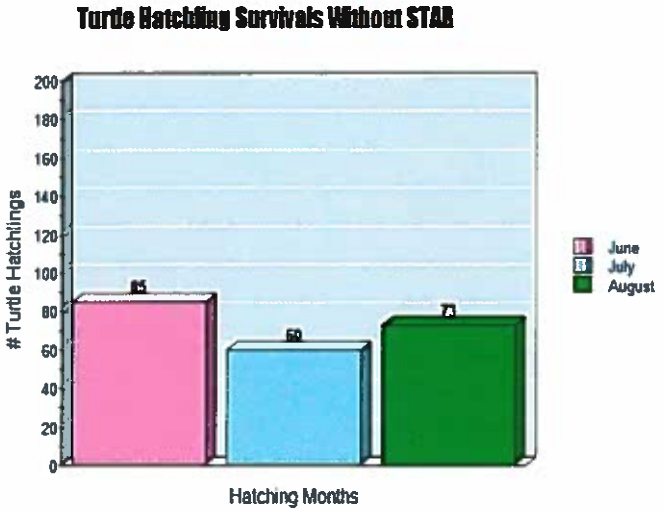
Breakthroughs

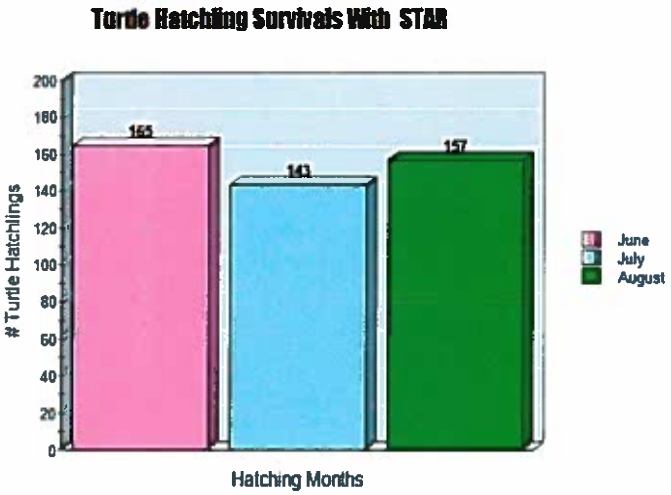
Scientists have been rescuing turtle hatchlings to some extent, mostly as part of research projects. As of today, no one has accepted how the fate of turtle hatchlings could affect the ocean environment and the food chain. In order for our technology to be available today, the solar powered, temperature- sensing pole with the retractable umbrella and infrared motion sensor, would have to be developed and installed on all nesting beaches. The government,

private citizens, or environmental groups would have to be agreeable to financing this system, so they would have to be convinced that this is a good idea.

To show that our technology will be useful we have designed the following experiment:

We will compare how many turtle hatchlings make it to the sea with our S.T.A.R. nest technology versus how many make it without. To do this we will observe turtle nests in selected breeding areas. A group of volunteer researchers will be watching to see how many hatchlings go toward the sea, how many head toward the bright lights of hotels or houses on the beach and how many nests are disturbed by predators. Since sea turtle breeding season runs from late Spring to early Summer, and it takes 2 months for the eggs to hatch, we have decided to count hatchlings over a 3 month period of June, July and August. Because we cannot tell if the hatchlings are male or female until they are older, we will not be able to test the advantage of the solar powered shade umbrella which is used to keep the nest at a normal temperature at this time. The following graphs prove that the S.T.A.R. technology of the future will work in our pretend experiment.





Design Process

Our S.T.A.R. technology of the future was designed in several steps. Originally, we had thought to put some kind of tracking devices on the front of vehicles on the beach to prevent eggs from being crushed. We decided that this was too costly, not efficient, and difficult to enforce. We decided that it would be better to keep the vehicles away from nesting areas altogether by using some kind of marking system, such as a pole or fence.

We had also considered using Solar powered robotic hatchlings to surround the nest with wire mesh fencing and lead the hatchlings to the sea, then return to the pole. We decided that there was no guarantee that the real hatchlings would follow the robotic hatchlings. We felt that this would not be practical. It would be costly, other animals might eat them and become sick, and beach goers might take them.

We knew from our research that turtle hatchlings are programmed to follow the bright light of the moon over the ocean. We felt that putting up light blocking blinds in apartments, homes and hotels on the beach that automatically turn on at night fall might help to encourage the turtles to go to the ocean instead of turning toward land. We decided against this because people don't want to spend a lot of money to vacation or live on the beach and not be able to see the ocean!

Our final design has all the parts that we need to keep the sea turtles safe.

Consequences

There are positive and negative consequences with our S.T.A.R. design.

Positive

One of the benefits of S.T.A.R.'s design is that the technology is already available and simple enough to create and distribute. With this design, scientists do not have to locate nests by waiting on beaches for mother sea turtles lay their eggs. The video from the night vision camera can be watched by scientists from a different location or at a different time. Another

positive consequence is that STAR is solar powered; it does not waste energy with batteries and electricity.

Negative

STAR does not provide complete protection from all the problems hatchlings face. It cannot prevent pollution in the sea, which hurts turtles if they mistake trash in sea for food (e.g. plastic bags that are mistaken for jelly fish and get stuck in turtles' throats). STAR cannot protect hatchlings from animal and human predators. Humans and other animals dig for sea turtle eggs for food. Wire fences have been created and can be placed with our design around the turtle nests to stop animals from digging for turtle eggs. Human poachers are harder to stop. When hatchlings crawl to sea, STAR does not protect them from birds and crabs, but its light should help them reach the sea faster.

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PHOTO CREDITS CITED IN DOCUMENT


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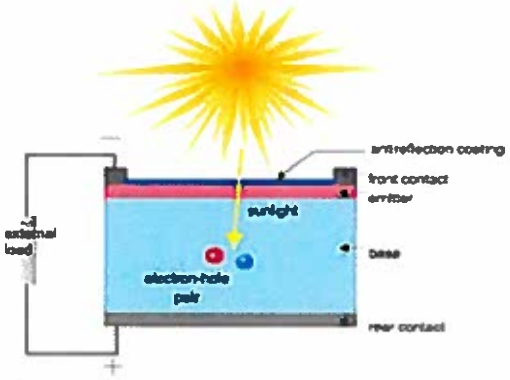
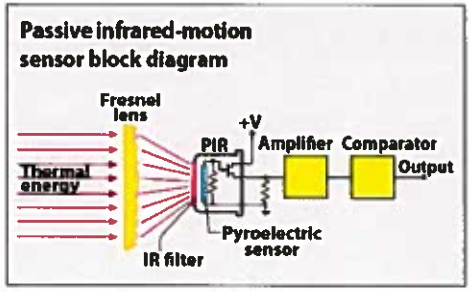
PRESENT TECHNOLOGY

Night vision camera



Solar cell

Temperature sensor



Motion sensor

HISTORY

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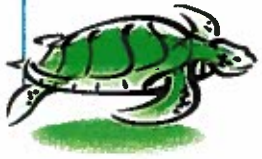

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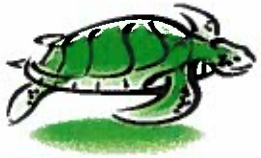
BREAKTHROUGHS

#1.The present technology needs to be further developed.

#2. Public awareness of the problem must be increased.

#3.Project must be funded.



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DESIGN PROCESS

#1.Tracking device on vehicles.

#2. Solar powered robotic hatchlings.

#3.Light blocking blinds for homes and hotels on the beach.

#4. S.T.A.R.

FUTURE TECHNOLOGY

*Night vision camera detects the mother turtle as she builds her nest.
*A pole with sensors and retractable umbrella is placed in the sand near the nest.
*The temperature sensor will cause the umbrella to open up if the nest temperature reaches above 84.6°C.
*The motion sensor will identify the movement of the turtle hatchlings and signal the light beam to shine above the nest and toward the ocean.

Click here for more information

CONSEQUENCES

POSITIVE

* STAR will be easy to create with existing technology.
* STAR is solar powered.
* STAR video of the nesting beach can be viewed from a remote location.

NEGATIVE

* STAR does not provide complete protection for hatchlings.
* STAR can not stop predators or human poachers.
* STAR needs to be funded by scientists, government or public resources.