Predator-Prey Model in an Ecosystem

Bill LATour Samuel J. Tilden High School
Sterlin Emile Samuel J. Tilden High School

Introduction:

No crash course can be more challenging than The SUMMIT program. It is indeed a great program that can help teachers create some hands on activities for class learning. Too often, teachers have been using simple 'talk and chalk' to teach classes where the environment is involved. The SUMMIT Program helps us focus on creating activities that can be used in class sessions. We started the program by having lectures followed by problem solving in the mechatronics laboratory. At the beginning, the material and subject matter seemed overwhelming. As a matter of fact, at the beginning some of us thought about quitting (as a matter of fact, one of us did quit). In time, however, I believe we all realized that we were working on topics and would be able to create activities that can readily be brought back to our students.

While we were getting heavy loads of lessons and activities for the first two weeks, there was a constant reminder that within the following two weeks from the lecture sessions, we would be working in teams of two on projects. Deciding on a project was a difficult task specially when the goal was to bring back to our students something meaningful and relevant to our teaching areas. Fortunately Bill and I both teach the same subject: Living environment and we both were concerned about creating a project related to at least one unit we have to cover in our curriculum.

Theory:

The predator-prey theory is based on the way energy travels in an ecosystem. A predator will consume a prey in order to acquire energy. Yet, only 10% of energy travel from one prey to a predator in a food pyramid. This explains why at any time in an ecosystem there should be always more prey than predators. Any time this balance is broken, the ecosystem will collapse. Animals prey on each other not for the fun of killing but in order to survive. This is the core learning target of that project: Teach students that life is precious and we, as human beings, should respect life.

System:

The small bug is used as a diurnal vegetarian animal looking for its energy source, the plant, during daytime. At night, it goes to sleep most often in a particular and specific place, its habitat.

How does our small robot-bug get its food?

The simulated plant emits a signal that is captured by the Infrared detector placed on the robot-bug (like a real bug would sense a flower and would move toward it because of the nectar it produces or its smell, color, etc.). The bug will get its energy from the plant and would go through its daily activities until nighttime.

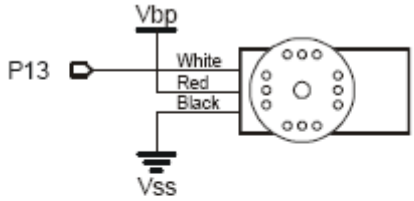
As nighttime falls, the nocturnal animals (usually the predators) will be looking for their food. In our project, the small bug will send a signal that will be captured by the Predator (the same way that a lion or a tiger would use their sense of smell to detect if there is

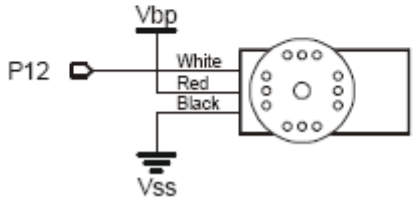
other animals around). Once sensed, the predator will move toward the weaker animal and would kill it for its source of food.

The driving force behind this entire predator-prey concept is achieved by the presence of the ultimate source of energy known as the Sun.
Without the energy from the sun, the green plants (producers) would not get the necessary energy to grow. Herbivores (primary consumers) would not be able to eat plants to get their energy and in return, predators (carnivores and omnivores) would not be able to survive due to a lack of food.
This Predator-prey model concept is the best to help students understand the interrelationship between organisms in the environment. Simulating hunting for the purpose of survival can help students understand our specific learning targets.

Circuitry:

PREY and Predator
Servo Motors connection





Whiskers

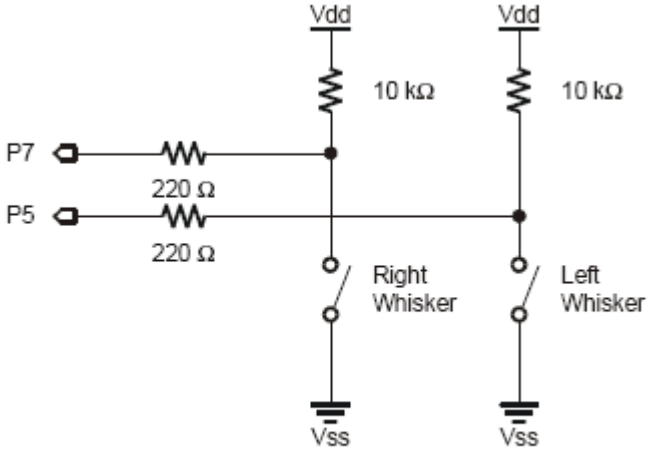
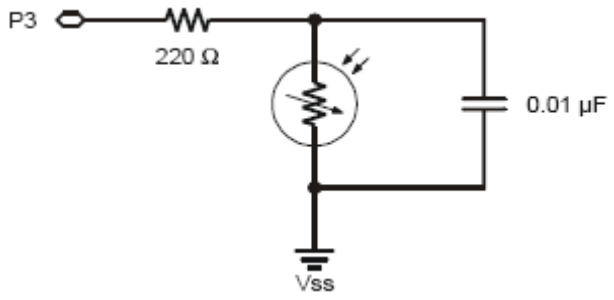
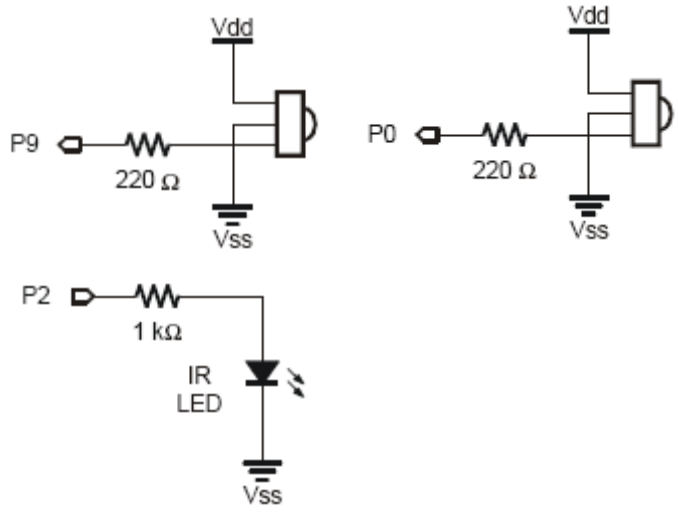


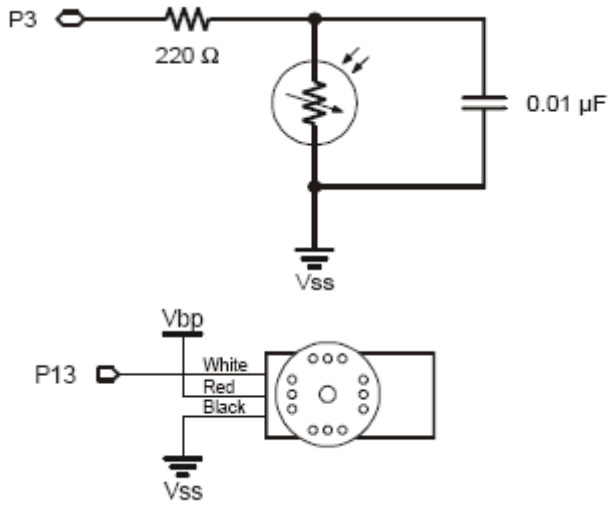
Photo-resistor



IR sensor and emitter



FLOWER



What are some difficulties did we encounter in designing the Project?

Our first concern was to create something meaningful enough in the time that was allotted to us and makes it relevant enough to take to our classrooms. A limited budget was also another constraining factor that we had to keep in mind while designing our project.

From the beginning, we decided that it should have a biological application due to the fact that in our school, we are encouraged to use hands on activities in our classes. On the first day of class after the first lecture, we went straight to Prof. Kapila with the idea that we would have to create some type of a sensor for detecting pH level, amount of ammonia and other toxic chemicals in a fish tank. He rejected this idea, stating that a previous group already did it. Bill suggested that we created some type of a robot that could lift up rocks at the bottom of a tank and pick up the waste in order to leave the tank clean (by the way this is really cool project idea that any future group should explore). I thought it was a good project but very time consuming. Therefore, we decided to drop it. Finally we decided on the predator-prey project simulating the real action in the living world. We focused on this project because we believe that we would be able to demonstrate how an ecosystem works. We also knew that if we were successful in our design and construction, we would make it more realistic for our students when we have to teach them about Energy flow, and other relationships among species in an ecosystem.

Conclusion:

There are no words to express our sincere thanks for the SUMMIT Program which allows us to materialize one of the key concepts of biology taught throughout the Living Environment curriculum. We are grateful to Prof. Kapila and his dedicated staff for helping in such a professional manner.

Probably, the ultimate beneficiaries for all the conjugated efforts will be our students who would have to visualize really Predator-Prey in action!