Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Invention)
(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: SABC291

Project Title: Xtinction sim

Project Type: Invention

To our best knowledge, there are * ***similar works in the market*; (if there are,) related product links are as below:**

cellular automata / rock-paper-scissor stimulator https://www.youtube.com/watch?v=0Kx4Y9TVMGg

The enhancement our project made / the difference with related products are:

The species stimulator is unique. It investigates an invasive species towards the effect of local species.

Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.

I. Background

Biodiversity conservation is an international focused target. Countless organisms around the globe are threatened by invasive species or different crises. In this stage, we used Romer's tree frogs as an example. Romer's tree frog *(Liuixalus romeri*) is a native species of Hong Kong which is currently threatened by an invasive species called Greenhouse frog (*Eleutherodactylus planirostris*). Our invention is a simulator that simulates the daily lives of both species. Through this, scientists and ecologists can predict the time when Romer's tree frogs face crises such as lack of food due to competition, so that precautions and measures can be made on time.

Simulators nowadays have no databases that would show the relationship of a complex food web. In addition, there is limited information for researchers to predict the future trend of species population, nor can it estimate which particular factor would affect the overall population of species. Currently available platforms can only record the data of certain species but cannot show the relationship between two or more organisms. Our invention can also show movements of organisms. This leads to a better understanding of interactions between organisms.

II. Objectives

We aim to predict the trend of population of Romer's tree frogs and Greenhouse frogs accurately by inputting the characteristics of the selected species. Moreover, we hope to investigate the competition between the two species and potential outcomes in the long run.

Since our system is customizable, it allows ecologists and scientists to use it as a research tool by altering different parameters. After running the program and conducting output analysis, they can take the corresponding measures to maintain biodiversity and protect endangered species.

III. Methodology

In order to simulate the interactions between Romer's tree frogs and Greenhouse frogs, we created a simulator using pygame in Visual Studio Code, where we can adjust different variables and environmental factors in order to extensively research the effects of those factors on the biodiversity and balance of the three species, the third one being the food source of the two frogs. The use of a computer program reduces the cost of research while still yielding promising results if coded concisely.

We used 5 Romer's tree frogs, 5 Greenhouse frogs, and 20 crickets as our initial testing subjects. Their interactions and behaviors are investigated using Visual Studio Code as our IDE and Python as our programming language. Then, the varying behaviors of the animals are determined by randomly generated numbers. In the simulator, the amount of energy, or food needed is assumed to be directly proportional to the frogs' mass. A list of variables is used to store the hunger level of the frogs. Furthermore, older frogs that have an age exceeding 70% of their typical lifespan have a continuously decreasing survival rate.

IV. Design of Invention

Our invention demonstrates the relationship between Romer's tree frogs and Greenhouse frogs by simulating their behaviors and interactions. The platform includes custom-coded behaviors, such as food intake levels, that classify the frogs as "fed", "hungry", or "starved". Population changes are based on successful reproduction frequency, which varies based on age, food availability, and environmental conditions. The simulation also allows us to demonstrate the competition for food between the two species.

V. Application / Market Need

The use of a computer program reduces the cost of research while still yielding promising results if coded concisely.

We hope our system can help researchers, especially ecologists, to have authentic demonstrations in the relationship between trophic levels and ecosystems. As a result, scientists can take corresponding actions to help conserve and protect specific species.

However, due to limitations of time and resources, we cannot make the whole platform with authentic pictures. As a consequence, we hope to develop a more comprehensive system with multiple food chains and a larger variety of species so as to allow scientists to investigate the relationship between species.

Recently, there are simulating platforms in the market, but most of them focus on a small area of biodiversity, making it hard to predict the trend of multiple species. None of the available simulating systems allows the virtual employment of management strategies the way our system does. Since we cannot ensure the effectiveness of such strategies or their long-term impacts, it is important that pathways are provided for the user to explore the vast number of outcomes that may occur.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. ***(Word limit: 300 words)***

The ultimate goal of our invention is to emphasize on the benefits and welfare of all organisms. Among the 17 goals of sustainable development, we are attempting to achieve the 14th and the 15th goal. To ensure the conservation and restoration of both terrestrial and aquatic organisms, our simulator simulates the crisis faced by them. Our users, ecologists, can then provide necessary countermeasures before it is too late. Our invention is important for sustainable development of all organisms since our users can get a grasp of an accurate time to take the corresponding actions for conserving species which are endangered. Our simulation can also make use of a database for further investigation of species. Our team fully believes that having a better awareness of the future largely increases the rate of success of our goals. Saving our precious organisms is the same. By getting a glance of the future using our species simulator, our users have a higher success rate and a clearer goal on what and when to provide aid for organisms.

VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. ***(Word limit: 300 words)***

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VIII. Conclusion

In conclusion, we have fully accomplished our objective for conservation of all organisms. Our invention simulates the growth of species and offers important insights into the interactions between local and invading species. Via our platform, ecologists and other experts may recognize impending threats to certain species earlier. Finally, conservation and countermeasures can be executed before it is too late. By predicting future trends more easily, the success rate of conserving certain organisms will rise significantly.

□ **Our project is developed based on previous project and the enhancement is below:**

N/A