福寿螺卵清除计划
Channeled Apple Snail Eggs Removal Project

彭仡阳
Michael Peng

今年五月，我在滴水湖附近的乡村小路散步时，发现了河岸上有一些粉红色的小果实。最初我以为它们是未成熟的黑莓，但当我拨开它们时才发现原来是卵。我仔细思考后意识到，鱼卵从来不会黏在水面上，所以这些应该是田螺的卵。当我仔细观察水底时，还发现有七八只像网球一样大的巨型螺在浑浊的水中缓慢爬行。它们庞大的身躯吓了我一跳，但我充满好奇的捞起了一只。这是我第一次注意到上海地区大规模的福寿螺入侵，也给了我很大的启发。

回到家后，我决定研究一下这个特殊的物种，发现它们被称为福寿螺（学名：Pomacea canaliculata）。这种螺最初来自巴西，在 1981 年引入广州后便被大量人工繁殖，因为当时人们认为它是一种美食。然而，这种想法并没有持续多久，因为这些螺散发出的恶臭味，和身上致命的寄生虫，使得它们很快被抛弃。将这个物种引入自然环境是一个致命的错误。福寿螺的繁殖速度极】快，每年能繁殖 2 至 3 代。一只成年雌性福寿螺在每个繁殖周期可产下 500 枚卵。此外，福寿螺对天敌的反应速度极快，并且它们的淋巴系统能在 15 天内使受损的外壳部分再生。凭借这些超能力般的特性，福寿螺迅速成为中国最有害的入侵物种之一，尤其是在上海等东部地区。

通过研究，我制定了一个任务，即通过清除福寿螺的卵来减少其数量。我的方法是制造一台水上无人机，利用人工智能检测福寿螺的种子并将其清除。尽管水上无人机在清除福寿螺卵方面可能具有潜力，但其有效性仍需要进一步研究和实践验证。福寿螺卵通常粘着在水生植物、岩石或其他表面上，且它们的大小和形状可能各不相同。因此，开发适用于不同卵的检测和清除技术是至关重要的。水上无人机可以配备先进的图像处理和人工智能技术（OpenCV），用于检测和识别福寿螺卵(程序会先通过图片训练来辨别福寿螺团)。它们可以使用摄像头或其他传感器来扫描水底，并利用算法来辨别和定位卵。然后，无人机可以使用机械臂、喷射器或其他装置来清除这些卵。因此，为了实现这个目标，我需要环境科学和机器人工程方面的专业研究人员，他们将为我的最终产品提供重要支持。

这个偶然的机会激发了我对环境保护和创新解决方案的热情。考虑到福寿螺入侵问题的严重性，我们需要及时采取措施来保护生态系统的平衡和生物多样性。通过应用科技和跨学科的研究方法，我们可以找到创新的解决方案，以应对类似的环境挑战。

It has recently come to my attention that the apple snail invasion in Shanghai, During May this year I was meandering through the suburban plant fields until I came across a river. This was no ordinary river; I realized the banks had those small pink clumps. At first, I thought these were strange fruits because they resembled unripe blackberries, but when I poked at them, I realized that these were no berries, they were eggs. Who laid them, I wondered, fish eggs are never attached to a surface wall, so they must be snail eggs? It was when I investigated the water and saw what proved my hypothesis, there were about 7 to 8 giant snails as big as tennis balls crawling in the murky water. I was so surprised by its gigantic mass that and pulled one out.

After coming home, I decided to research this snail species and found they were called channeled apple snails (*Pomacea canaliculata)*. I found that this species originated in Brazil, and was introduced to Guangzhou in 1981, it was then mass-reproduced in captivity because it was believed to be a successful food source. However, this idea didn't last long, these snails were soon discarded because of their intolerable stench and bad taste. Casting this species into the rivers was a fatal mistake. The apple snail species has an extremely fast reproduction rate, which allows it to produce 2-3 generations every year. An adult female apple snail can lay up to 500 eggs per reproductive cycle. Other special traits that this species is incredibly resistant to are their fast reaction to predators, and their lymph systems, which can regenerate broken shell parts in 15 days. It seems that, with these superpower-like traits, the channeled apple snails have quickly become the most detrimental invasive species in China, especially in the Eastern areas, such as Shanghai.

As part of my research, I aimed to decrease the population of apple snails by eradicating their eggs. My method involved creating a drone boat that utilizes artificial intelligence to detect and eliminate snail eggs. Though drone boats have the potential to remove the eggs, their effectiveness needs further study and verification in practical application.

(Refer to the image) The snail eggs tend to adhere to aquatic plants, rocks, or other surfaces that are above water level, and they can vary in size and shape.

It's crucial to develop detection and elimination techniques that are appropriate for different types of eggs. The drone boat could have advanced image processing and artificial intelligence (OpenCV) technology installed to recognize and distinguish Apple snail eggs (the program will initially be trained to recognize the Apple snail eggs through pictures). It could use cameras or other sensors to scan the waterbed and use algorithms to identify and locate eggs. Once identified, the drone could employ a robotic arm, ejector, or other device to remove the eggs. Accomplishing this goal necessitated the assistance of specialized researchers in environmental science and robotics engineering who would provide crucial support for my final product.

I firmly believe that taking action to preserve our environment is of utmost importance. We must act quickly to maintain the balance of our ecosystem and its biodiversity. Using technology and interdisciplinary approaches, we can develop innovative solutions to combat various environmental issues.

Photos of Channeled Apple snail eggs
Taken in the suburbs of Shanghai.

在上海郊区拍到的福寿螺卵。

Drone Boat concept design:
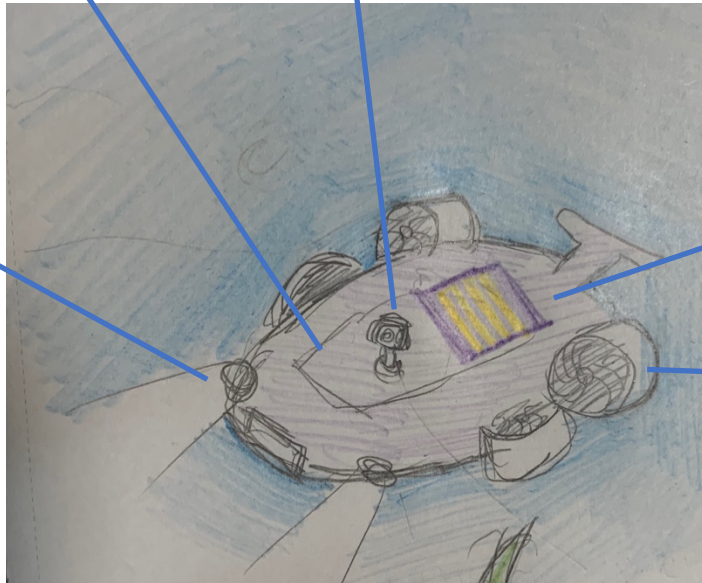
微电脑（eg. 树莓派）
Minicomputer (eg. Raspberry pi)

可移动摄像头
Moveable Camera

灯
Light

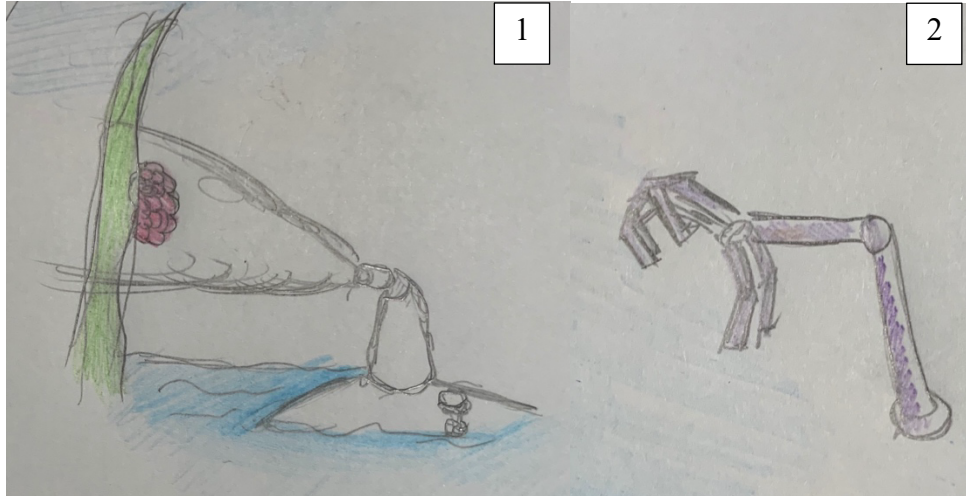太阳能板 (提供电量)
Solar Power Panel to provide battery power and remain autonomous

螺旋桨 Turbine

Drone Concept ART

#1 (Main Solution 主解决方案):

    Spraying Hydrogen Peroxide / Bleach to poison the eggs (chemicals may also have deadly effects on the snails, the chemicals will also not harm the plants but benefit them by removing other parasites and bacteria alongside the eggs.

    喷洒过氧化氢/漂白剂来毒死福寿螺卵(化学物质对蜗牛也有致命的影响)，这些化学物质也不会伤害植物，而是通过去植物上的寄生虫和细菌为它消毒。

#2 (Secondary Solution 次解决方案):

Attach a robotic arm to the drone, allowing it to snatch the eggs off whatever surface it is attached to.

在无人机上安装一个机械臂，让它从附着的任何表面抓取福寿螺卵。

Other Potential Designs: (created by AI)

Concept images of OpenCV (red rectangles) tracking of Apple snail eggs as the drone moves closer to it, allowing the bleach/hydrogen peroxide spray to exterminate the eggs precisely.

OpenCV(红色正方形)跟踪福寿螺卵的概

图，当无人机靠近它时，允许漂白剂/过氧化氢喷雾精确地消灭卵。

It is important to note that the OpenCV program needs to undergo extensive image search training to accurately identify any eggs present in every image. This requirement ensures that once the boat starts its operation, it will only detect the eggs and select them as its target.

Now the question is, how will the drone move around, locate, and exterminate the eggs? When the drone starts operating in the water, the camera, which directs the movement of the boat, will search for its target. Once an egg is detected, the camera will direct the turbines and propel the drone towards the target location. During its movement, the egg should always remain in the center of the camera's field of view and not be on the periphery. Since there could be more than one egg attached to a surface, the program should be set to detect only singular blocks or clusters at a time (refer to the OpenCV concept image).

The termination of eggs should only begin when the drone is near the egg or egg cluster. This ensures the accuracy and efficiency of the termination process.

Once the termination is complete, the drone will continue its systematic roaming and use its guiding camera to search for eggs and repeat the termination process. It is safe to say that the roam, detect, and termination cycle should be infinite and continuous, as this will ensure the destruction of most or all eggs within the drone's roaming environment.

自我介绍
My Self-Introduction

Hi，我叫Michael，是励滕高中11年级学生。我比较喜欢运动，尤其是街头运动滑板和网球；我也是一个自然爱好者，因为我非常关心全球变暖，以及如何减少人类对大自然带来的危害。

Hi, I'm Michael, and I am currently a junior at Shanghai Leighton School. I enjoy sports such as skateboarding and tennis. I am also a natural enthusiast, as I am concerned about global warming and how we can reduce our negative impacts on nature.

我的联系方式:
My Contacts:

微信/weixin ID: yiyang_peng
Instagram: Damikeyway

手机号/Phone: 86-139-1779-5931