NIALL DALTON

SEPTEMBER 2016

Saving the World’s Biggest Cat

Panthera tigris, commonly known as the tiger, is the world’s biggest cat. However, if trends continue, it may no longer able to hold that title. *Panthera tigris* is classified as “endangered” under the IUCN red list (Goodrich, J. et al., 2015). Tigers are found on the Indian subcontinent, parts of Indochina, Southeast Asia, and the Russian far east, where socioeconomic problems have led to the decline of tigers. Specifically, the demand for tiger bones in illegal markets, combined with poor welfare conditions in nations like India, exacerbate the craving to kill tigers for monetary gains. Methods to protect tigers involving legal protections and “protected” habitats have not shown to be very effective, as poaching is still rampant.

Goals

The ultimate goal of this project is to increase the tiger population. The following criteria provide an important basis for selecting the best method for achieving that goal:

- Highly effective solution to stopping poaching
- Viable solution
- Low cost
- Easy to manufacture
- Ensuring safety of both humans and animals involved
- Easy to facilitate usage of with local officials

Overall, these goals were chosen based on the real world needs of securing tiger habitats against poaching. Our solution provides an optimal intersection of satisfying these goals.

Proposal

PLANS THAT WERE CONSIDERED

1. Armed guards would be placed at perimeter position in a protected habitat zone and use non-lethal weaponry to stop potential poachers. This solution would require weaponry, transportation for the men, and pay for the guards, and therefore would likely be expensive and probably not very viable.
2. Lobbying for stronger legal protections and better welfare programs to disincentivize poaching. Lobbying would require lobbyists and large sums of money, as well as public support, but it would also be hard to implement and take a lot of overhead to tackle such a large socioeconomic problem set.
3. LIDAR sensors would be either implanted or placed in perimeter positions to either alert the tigers or local officials, respectively. This solution would still be expensive, but would likely be viable to set up and can be easily produced by third party manufacturers.

The third solution, specifically the implant variant, was chosen for its extremely high projected effectiveness. Despite the higher startup cost to buy the sensors necessary for this approach, this method is expected to be have a low long term cost. This solution also provides a design that is relatively easy to set up and does not require the large amounts of legal framework required by the first or second solutions.

HOW THIS PROPOSAL ACHIEVES GOALS

First, this solution uses 24/7 sensor data to provide full time protection in any scenario a tiger may encounter, thus providing a highly effective way to stop poaching. Moreover, sensors are easy to manufacture and are safe to use. Many other microchips and small devices are currently used on other animals today. Despite the larger initial startup cost to pay for the sensors, the sensors would not require constant upkeep and would provide large savings in the long run.

WHY THIS SOLUTION IS BETTER

The primary benefit of this solution is the degree of effectiveness it would have compared to previous solutions. In the past, poachers have easily evaded secured habitat locations and managed to kill significant tiger populations (Alexander, 2011). Furthermore, stagnant socioeconomic conditions have only increased the need to become a poacher, as it presents the potential for lucrative monetary gains. By having sensors that constantly and consistently prevent tigers from remaining in the vicinity of nearby poachers, tigers will have a much better chance at avoiding poaching encounters, which thus will lead to an increase in the survival rate of the tiger population.

Proposal Details

DESIGN

A small and unrestrictive LIDAR sensor ("VLP-16") will be placed along the tiger's head to allow for unobstructed lines of sight and optimal 360-degree horizontal vision. The VLP-16 is also capable of ~15-degree vertical field of view and has a range of 100 meters. LIDAR stands for Light Imaging, Detection, and Ranging. LIDAR sensors are capable mapping their surroundings in 3 dimensions. Current implant and nanotechnology would be incorporated alongside this sensor technology to allow for the inclusion of a self-contained unit with a small stereo speaker system. The speaker would make a harsh and unpleasant sound and use engineered acoustics to project the noise from the direction of the poachers, causing the tiger to run in a direction relatively opposed to the poachers. In terms of power consumption, plans for development include minimizing electrical draw to allow for a miniature solar power cell capable of providing constant power to be provided to the unit. Lastly, a microprocessor for handling the sensor data and controlling the acoustics would be a part of the unit. Ideally, the whole unit would be around 3 or 4 in^3 in total volume.

MANUFACTURING

Manufacturing would be done by various third parties and by our engineering firm. Consulting will be done with various biological experts to determine the parameters needed to ensure the safe implanting of the unit on tigers. The LIDAR sensor comes from Velodyne. The solar technology, acoustics system, and microprocessor would all be sent to a factory to be mass produced. The final assembly would be done in-house to ensure proper construction and adherence to the final reference design.

DISTRIBUTION

Distribution would be done through shipping to local governments. Then, implementation would be done by local officials and those presiding over tiger habitats. In the absence of such personnel, we would look for volunteers with experience in biology to assist in implanting the unit. A classic capture and release method would be used to do implant the sensor.

COST

Initial research would be roughly $20,000 US to develop the new technologies needed for the unit. The cost of each unit would be roughly $8,500, eight thousand of which is from the LIDAR sensor. In the near future, however, the cost of a similar LIDAR sensor is projected to decrease to the hundreds of dollars. Given this projection, a similarly functional unit would be roughly $750 dollars in the near future. This price is the more accurate base upon which to make further assumptions on with regards to the current timeline (See Timeline section below). Although one unit would have to be implanted on each tiger, this solution would provide cost savings over a 24/7 armed guard solution and would not need large sums of money to maintain itself. Moreover, as technology continues to get cheaper, projections many years into the future are predictive of an even cheaper cost for each unit.

People and Policy

POLICIES AND STANDARDS

Policies would include using all pertinent lab safety techniques during development and following legal guidelines for all countries that tigers currently reside in. For the implant itself, a more in-depth policy would be outlined with local officials, but several general statements apply: The tigers should not be harmed in anyway, the main goal of this project is to help save tigers from poaching, and that the project is non-profit.

PEOPLE INVOLVED

Several teams will have a hand in both the development and implementation of the project. First, our teams of engineers will collaborate with various companies, such as Velodyne and Intel, to create a design for the unit. Manufacturing heads of the respective companies will work either in-house or contact factories to mass produce the units. Finally, local officials and teams of volunteers with biological experience will help undertake the implanting phase.

EXPERTISE

The engineers from Velodyne are highly experienced in LIDAR technology. Likewise, our firm has many highly qualified engineers in a variety of fields, including, but not limited to, software, audio, and hardware. Combining the talent in these various fields will allow us to efficiently design and implement a working product. Our prior work on designing small microprocessor controlled sensor units has given us the applicable skills needed to complete this project. Moreover, outside help and advice from biological experts will allow us to create a unit that is safe and effective when implanted on the animal.

Timeline and Funding

TIMELINE

Assuming ideal conditions and provided funding, development should take ~6 months. First, manufacturing and shipping would take a few months, roughly 2. Next, legal approval and volunteer signups would also be needed, both of which are hard to predict an accurate timeline for. Afterwards, actually implanting a significant portion of the tiger population that is vulnerable to poaching would hopefully be done within a year. The second phase, involving implanting the unit, may take a different amount of time for different tiger locations. Overall, a very approximate estimate is to have a significant portion of tigers implanted within 2 years.

ANTICIPATED CHALLENGES

We are predicting that a small number of issues may arise during development and implementation. The primary concern is minimizing size so as to not interfere with the daily life of the tiger. Elements such as the solar power cell will have to be extremely efficient in capturing energy due to the small size constraints and similarly the audio system will have to be able to be both small, loud, and highly accurate. We believe, however, that our engineering team is more than up to the task.

FUNDING

Funding will come from donations and grants from benevolent countries, as well as from animal rights and preservation organizations.

Conclusion

Our unit would provide an early warning system to tigers to save them from poacher's attacks, thus increasing their survival rate in the wild and moving their position off the IUCN Red List. In sum, our unit consists of a small LIDAR sensor and acoustic system, both controlled by a microprocessor, that would detect and alert tigers of nearby humans. It would be developed by our firm and implanted into a significant portion of the tiger population. Finally, by providing a constant protector and without requiring human interaction, our unit would provide a highly effective solution compared to the inadequate local struggles against poaching.

References

Alexander, Caroline. "A Cry For The Tiger". National Geographic. N.p., 2011. Web. 18 Sept. 2016.

"Basic Facts About Tigers". Defenders of Wildlife. Web. 19 Sept. 2016.

Crawford, Mark. "Implantable Sensors Make Medical Implants Smarter". Asme.org. N.p., 2013. Web. 20 Sept. 2016.

Goodrich, J., Lynam, A., Miquelle, D., Wibisono, H., Kawanishi, K., Pattanavibool, A., Htun, S., Tempa, T., Karki, J., Jhala, Y. & Karanth, U. 2015. Panthera tigris. The IUCN Red List of Threatened Species 2015: e.T15955A50659951. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T15955A50659951.en. Downloaded on 18 September 2016.

Poulton, Christopher and Michael Watts. "MIT And DARPA Pack Lidar Sensor Onto Single Chip". IEEE Spectrum: Technology, Engineering, and Science News. N.p., 2016. Web. 21 Sept. 2016.

"VLP-16". Velodyne LIDAR. N.p., 2016. Web. 20 Sept. 2016.