

Human-Animal Conflict Avoidance System

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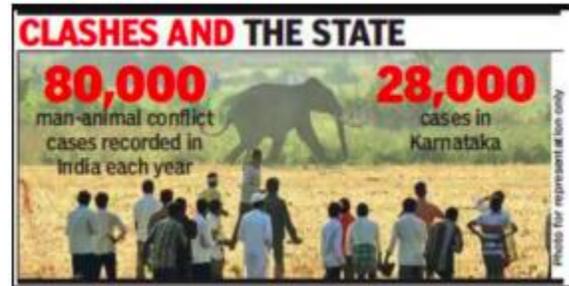
Abstract- This paper demonstrates a detection system that is useful in detecting and avoiding incidents of potential human and animal conflict. The system detects the presence of any animal of concern using image recognition. It then triggers a phone call to the concerned authorities about the presence of the same. The system is useful in areas where animal infiltration is frequent in human communities. It will prove helpful in places where animals can cause significant damage, such as loss of human lives, crops, infrastructure, etc.

I. INTRODUCTION

Humans and forests have shared a significant relationship for millennia. Forests have played a key role in the development of human society and culture. The importance of forests has been ingrained in the human psyche. This is evident from the cultural and spiritual importance that has been assigned to forests. The earliest of humans lived in caves. They foraged wild berries for food, hunted animals for meat and hides. When fire was discovered, humans were heavily dependent on forests for firewood. Steadily, over time, we discovered novel ways of using wood to make our lives easier. Our dependence on forests staying secure.

Even in the present-day world, there are many tribal societies that still live inside a forest. The Amazon Forest in South America is home to about 80 tribal societies that are completely cut off from the modern world. The North Sentinel Island in India is home to the Sentinelese tribe.

We are no longer in the stone-age era. Humans are no longer “forest dwellers”. But our lives continue to remain heavily integrated with forests. Many villages in India are located near forests. Indigenous people in India are also allowed to live inside forest reserves and wildlife sanctuaries. This is because the livelihood of the villagers is heavily dependent on the resources that they procure from a forest. But this proximity also gives rise to the problem of human-animal conflicts.



Instances of conflict between humans and animals are often heard about in the news. Baboons attacking cattle in Namibia; One-Horned Rhinos destroying crops in Nepal; bears and human-animal conflict on the rise?

What is human-wildlife conflict?

When animals directly and repeatedly endanger people's safety or way of life, it is called a human-wildlife conflict (HWC), and as a result, that species is persecuted. Conflict over the best course of action often results from retaliation against the species that has been accused. Although this is not a new scenario — people and wildlife have coexisted for millennia — it is one that is serious, pervasive, increasingly common, and a global issue for both development and conservation. In addition to the majority of large carnivores, HWC also affects a wide range of other species, including but not limited to elephants, pigs, deer, primates, sharks, seals, birds of prey, crocodiles, rhinos, and otters. HWC also frequently has a negative impact on the livelihoods, safety, and wellbeing of the people we ask to contribute to larger conservation goals. It also has an impact on many countries that are attempting to cooperate with and gain from conservation and development programs.



Why is human-wildlife conflict on the rise? People and wildlife are increasingly interacting and competing with one another for resources as human populations and space demands rise. This can result in more human-wildlife conflict. Conflict between humans and wildlife has contributed to the decline of once-abundant species and is bringing other species to the verge of extinction, along with other threats. But the issue of human-wildlife conflict has far-reaching effects that go beyond the immediate effects on wildlife and communities. Since interactions between wildlife and people are the main source of human-wildlife conflict, efforts to promote human-wildlife coexistence are crucial to sustainable development. These activities and conservation more broadly could be negatively impacted by human-wildlife conflict if it is not effectively managed.

Who is impacted by human-wildlife conflict and in what ways?

Conflicts between humans and wildlife in India have an impact on the country's wildlife population as well as the livelihood, security, and general well-being of the human population, particularly in areas where human settlements are close to wildlife habitat. Cases of carnivore attacks, such as those by tigers, leopards, wolves, etc., that result in cattle lifting, man-eating, livestock depredation, human injury, etc. occasionally make the news. Additionally, crop raiding by herbivores like elephants, wild cattle, wild boars, etc. is a common occurrence throughout the nation and has a significant negative impact on farmers' livelihoods. Injuries from reptile attacks, damage to aircraft from collisions with flying birds, and other less frequent but observed harms caused by human-wildlife conflicts include harm to the human community. However,

because of problems with human-wildlife conflict, wildlife suffers the most casualties. According to observations, human attitudes toward wildlife become hostile as a result of conflicts between humans and wildlife. As a result, there are cases of poaching, illegal wildlife trade, and the killing of wild animals as a form of retaliation. These activities are also made worse by factors like poverty, population growth, etc.

The recent death of a pregnant elephant in Kerala from eating a fruit that had been stuffed with firecrackers has received a lot of media attention and drawn harsh criticism from netizens and wildlife conservationists across the nation. But when we consider this incident in the context of the larger problem of human-wildlife conflict, it becomes clear that it is just one of many instances in which human-wildlife conflicts have irreparably damaged India's wildlife community.



Wild animal deaths from traffic, collisions with trains in motion, and vehicles being run over are all very frequent occurrences. According to surveys, between 1987 and 2018, 249 elephants died on railway tracks after colliding with moving trains. One of the biggest threats to the continued existence of the wildlife population is poaching. In India, large-scale poaching and illegal trade, along with a variety of other factors like electrocution, habitat loss, seizure, etc., have significantly reduced the population of wild carnivores, particularly tigers.

The most immediate victims of conflict between humans and wildlife are wildlife and the nearby communities. Communities may suffer financial losses and threats to their health, safety, way of life, food security, and property, while human-wildlife

conflict may lead to the decline and eventual extinction of certain species. While the global community benefits from healthy wildlife populations and healthy ecosystems that enable us to survive, provide food for our families, and support our livelihoods, the costs of living with wildlife are unevenly distributed and fall disproportionately on communities that frequently encounter systemic barriers, have incomes well below the poverty line, and have limited access to economic opportunities.

Human-wildlife conflict is thus both a development and humanitarian issue, as well as a concern for conservation, as it has an impact on the income of farmers, herders, and artisanal fishers, especially those whose incomes are below the poverty line. Aside from the direct losses to In communities, human-wildlife conflict also has an indirect impact on people all over the world due to the strain it puts on the production of agricultural products and the global supply chain, which results in food insecurity and decreased productivity among producers.

Reasons Behind Rising Instances of Human-Wildlife Conflict

According to research, the growing interaction between the human and wildlife populations is one of the main causes of the human-wildlife conflict in India. This, in turn, has occurred as a result of a number of factors, such as the reduction in the "size and quality" of the habitats available for the wildlife population due to anthropogenic factors like encroachments, deforestation, denotification of protected areas (PA), Availability of palatable food outside of PA, behavioral factors, etc.

Other factors contributing to an increase in human-wildlife interactions include widespread poverty in India, rapid population growth, inconsistent payments of monetary or other forms of compensation to farmers by state governments, losses to livestock or crops as a result of wild animal attacks, etc.

- Objectives

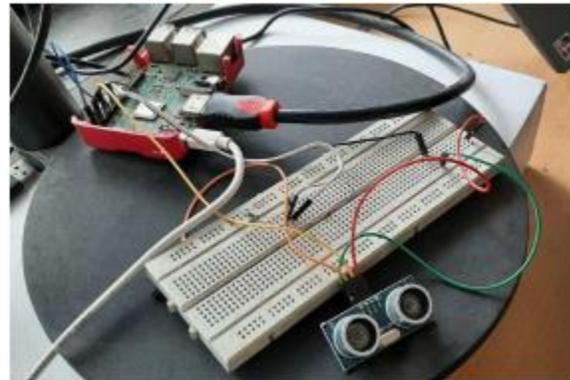
Communities that still live near forests are the ones that have very sustainable ways of life. They live in harmony with nature. Ironically, they are the ones who are the most vulnerable and susceptible to the

destructive forces of nature – animal attacks being one example out of a multitude of them. The objective of this project is to reduce human-animal conflict and hence protect wildlife and vulnerable human communities. It also aims to protect crop fields that are often a place where grazing animals wreak havoc, thus affecting a farmer's livelihood.

II. ARCHITECTURE

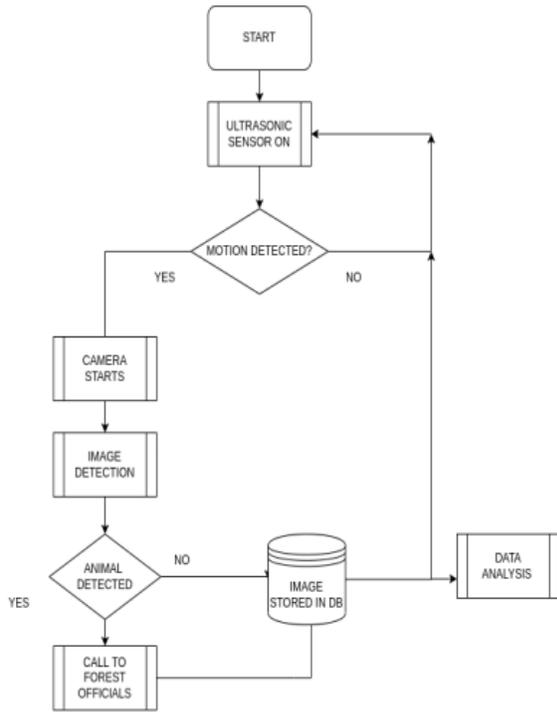
The project consists of a Raspberry Pi unit, which is the heart of the project. Additionally, there is a camera module: Pi Cam, an ultrasonic sensor, jump wires, resistors, and a breadboard to assemble it all together.

III. SYSTEM DESIGN



The ultrasonic sensor keeps sending waves to detect any obstacles. Whenever it senses an obstacle, the camera is triggered to take a picture. The picture is then sent to a downstream service (Clarifi API) for image detection. If the image detected is of any animal of concern, another downstream API, Twilio, is called. Twilio will make a phone call to the concerned authorities to let them know that an animal has been detected in the protected vicinity. The image will also be stored in a centralized database. This database will be used to analyze the frequency of infiltration of animals. The analyzed data will help forest officials take relevant and adequate measures to curb human-animal conflict.

IV. WORKING FLOWCHART



V. RESULT

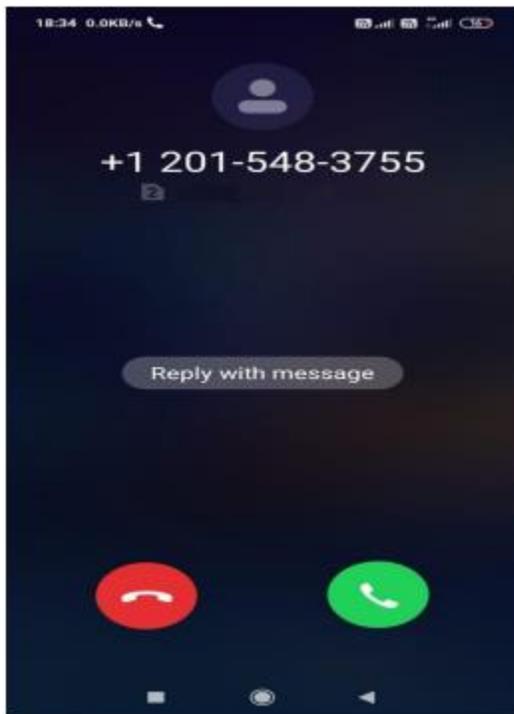


Figure: Twilio triggered phone call

Through this project, we aim to minimize human-animal conflict in areas such as

1. Human communities in wildlife reserves and sanctuaries
2. Agricultural Fields
3. Railway tracks

We have been successful in detecting the presence of an animal and alerting the concerned authorities. Our scope of operation remains limited to detecting the animal and initiating further steps towards its removal from the area. This is only a part of the solution to the problem of “human-animal conflict”. The latter part of the solution, which is, the actual act of removing the offending animal, lies beyond the scope of our project.

The scope of our project can be defined by the following parameters:

We tested the setup with 100 images of different animals. The response was 93% accurate. 7% of times the images were blurred and hence the response received was not accurate.

The setup works upto a range of 4m. Beyond four metres, the ultrasonic sensor is unable to detect any object.

The latency of the response is 23 seconds. This is the time elapsed from the moment the camera clicks a picture till the time a phone call is received.

CONCLUSION

Challenges in Addressing Human-Wildlife Conflict in India, resolving the conflict between people and wildlife presents a number of difficulties. The complexity of the causes of these conflicts, which frequently have multiple dimensions attached to them such as cultural, political, economic, etc., is the main reason why complete mitigation of this conflict is very challenging. The task of mitigation becomes more difficult because these dimensions and their relationships are frequently not well understood. Initiatives for the recovery of endangered species are not without difficulties. One of them is making enough habitat space available for the expanding number of wildlife species. One can easily comprehend the enormity of this challenge against India's continuously

expanding human population. Another grave challenge is the prevention of retaliation against wildlife by the human population. We do have legislation to protect and conserve wildlife in the form of the Wildlife Protection Act (WPA), but it has been found that the penalties outlined in the 1972-passed original Act and its later amendments are insufficient to stop crimes against wildlife.

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