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Innovative fence monitoring system to mitigate human-elephant conflict

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Human-elephant conflict (HEC) poses a significant threat to communities and wildlife, prompting the development of an innovative standalone device to enhance electric fence monitoring and mitigate associated risks. This research introduces a system that determines breakage location by measuring fence capacitance, inductance, and resistance, and uses a mathematical model to map changes of these parameters to change of the fence length. This approach enables remote detection of both open and short circuit breakdowns without relying on expensive, failure-prone active nodes along the entire fence. The device can identify the distance to the breached location along the length of the fence approximately and immediately. It will send this alert via SMS to designated contacts using a GSM module, providing real-time monitoring and rapid response capabilities. This key feature ensures timely alerts and quick responses to potential breaches, enhancing the fence's effectiveness in preventing elephants from entering villages and reducing HEC incidents. The standalone nature of the solution simplifies installation and maintenance, eliminating the need for additional wiring or complex infrastructure, thereby significantly reducing overall costs associated with fence monitoring while increasing reliability and efficiency. Furthermore, the device functions accurately by minimizing the effects of weather changes, ensuring consistent performance in various environmental conditions. This innovative breakage detection system represents a significant advancement in fence monitoring technology for wildlife conservation, addressing many shortcomings of traditional solutions by offering a cost-effective, efficient, and reliable method for mitigating human-elephant conflict. The research underscores the potential of integrating advanced technology with traditional conservation methods to create more sustainable and effective strategies for managing human-wildlife conflicts, ultimately improving the effectiveness of electric fences in deterring elephants and reducing the incidence of fatalities and crop damage. Testing on a 150m fence demonstrated promising results, with the system achieving nearly 80% accuracy in detecting and locating both open circuit and short circuit breakages, as verified through manual simulations and observations recorded in the device's test results.

Keywords: Electric fences, Human-elephant conflict (HEC), Real-time alerts