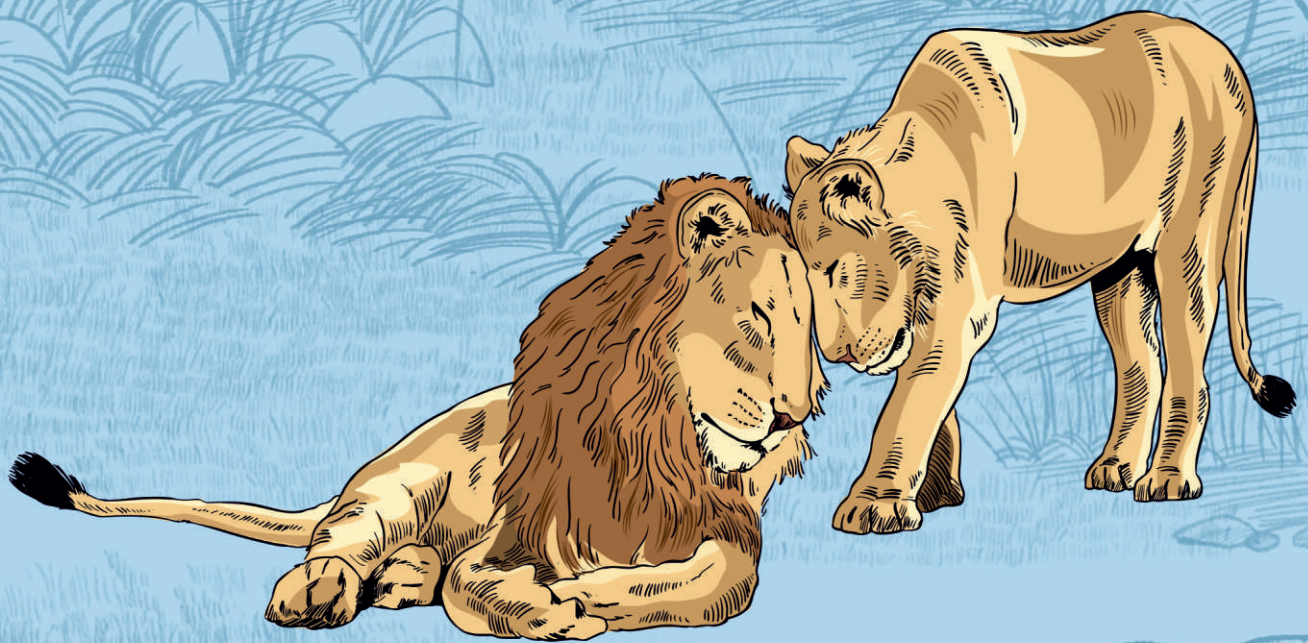


# Gir Hi-Tech Monitoring Unit

Advancing Learning  
through Cutting-edge  
Technologies







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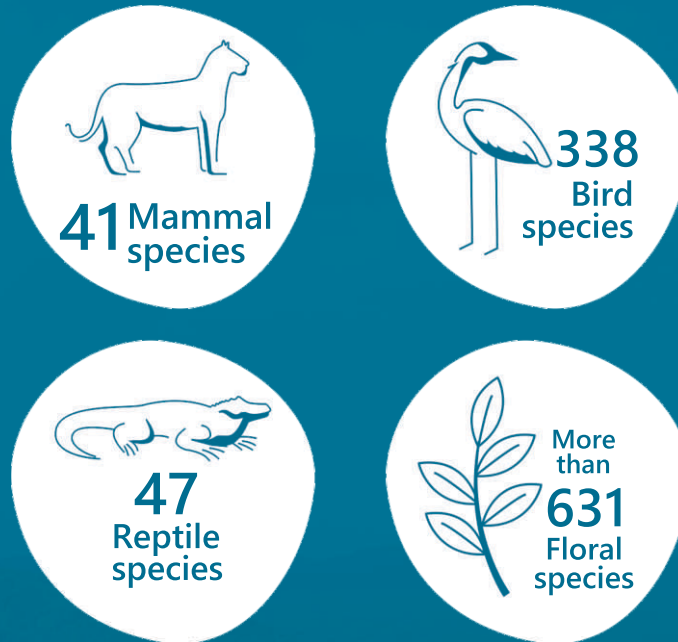
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## About Gir

Nestled in the Gujarat state of western India, Gir is a unique abode of the majestic Asiatic lions, featuring a flourishing ecosystem. The area resonates with the roars of these big cats and boasts breathtaking landscapes, abundant wildlife, and serene surroundings.

This vibrant ecosystem hosts....



...Within this ecosystem, the majestic Asiatic lion serves as a flagship species, embodying a remarkable conservation success story on a global scale. The Gujarat Forest Department (GFD) has employed multiple strategies aligned with the latest state-of-the-art technologies to achieve this success.

Scientific monitoring and research play a pivotal role in comprehending the habitat's ecology and managing various facets of its management. The data and insights derived from monitoring and research activities guide managers in making informed decisions regarding conservation and management actions. In a landscape marked by evolving dynamics, including urbanization, ecotourism, human-wildlife conflicts, a growing population of wildlife, intricate ecological interactions among species, and rescue and rehabilitation efforts, a knowledge-based, scientific approach is important for effective conservation and management

In Gir, the park managers have continually expanded their capabilities to monitor and gather scientific data. Embracing a technology-driven scientific monitoring initiative, the state-of-the-art Gir Hi-Tech Monitoring Unit was established in Sasan-Gir in 2019. This unit meticulously monitors and analyzes various aspects, including advanced radio-telemetry studies on carnivores and avifauna, wireless communication, e-GujForest data, microchip datasets, surveillance at entry/exit points, and the movements of safari vehicles. Comprising three distinct units, this establishment represents a significant step toward achieving informed and scientifically grounded conservation and management within the landscape. Below are the details about the systems housed within this unit.



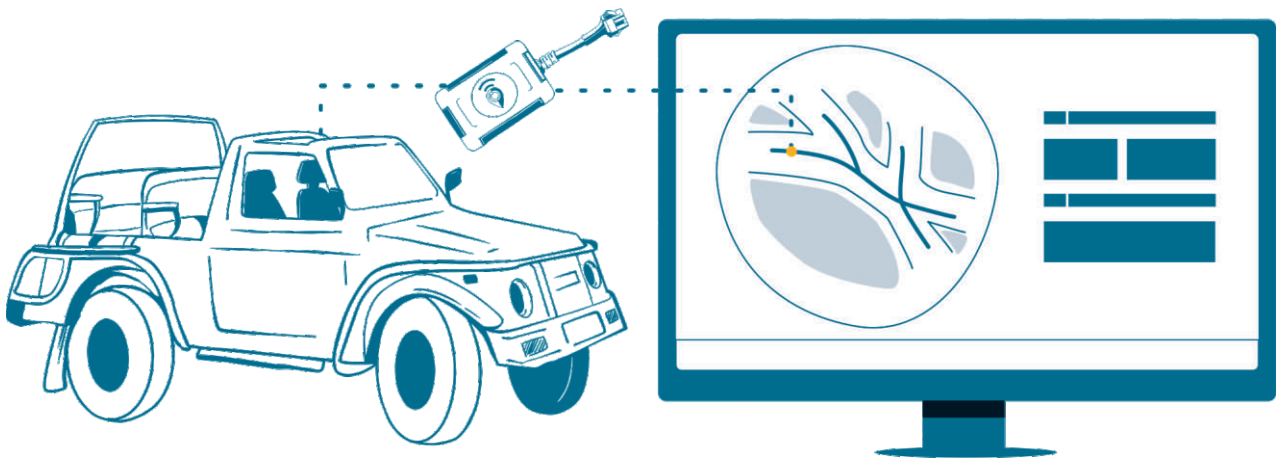
## Safari Vehicle Surveillance System

The Safari Vehicle Surveillance System was envisaged to enhance ecotourism management in Gir by adopting a conservation and visitor-centric approach.

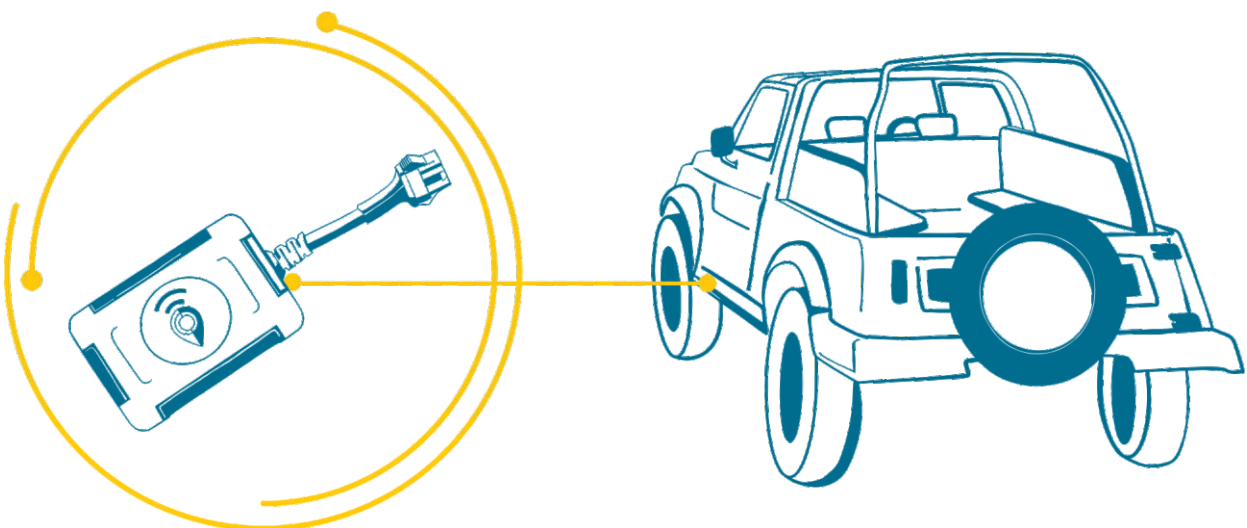
Gir receives approximately eight lakh visitors annually who embark on safaris assigned to specific routes by the park management authority.

The surveillance system for safaris monitors the movements of the safari vehicles. It enables tracking each safari vehicle scheduled for a particular time slot, ensuring it adheres to its designated route while carrying visitors.

The system records data such as their movement on prescribed routes, instances of over-speeding, stoppages, and off-routing, etc.

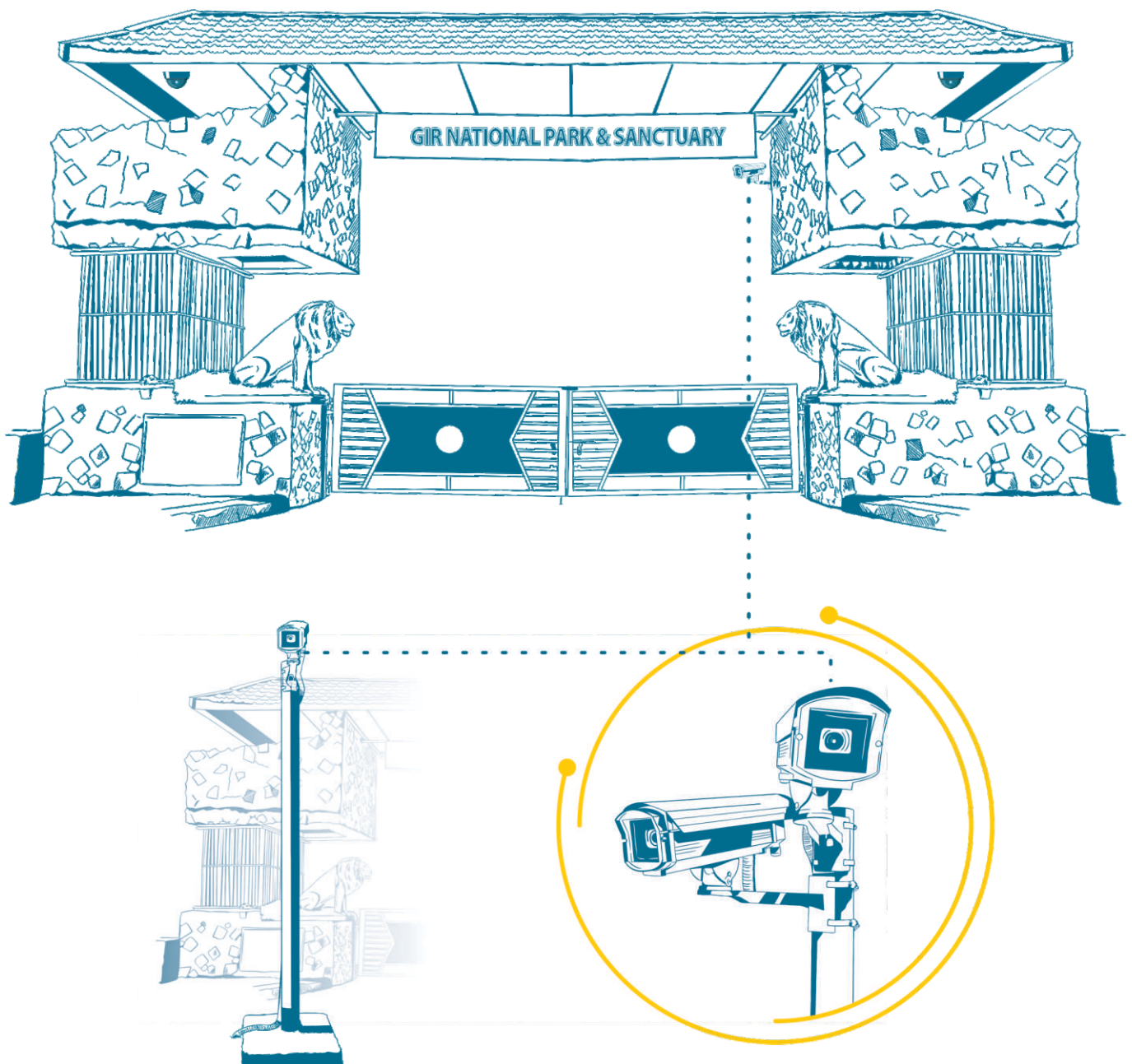


These data play a crucial role in promptly addressing any operational issues that may arise and are also subject to analysis for improving ecotourism management practices in Gir. By implementing this system, Gir aims to provide a safer and more enjoyable experience for its diverse visitors.



## CCTV Surveillance System

The CCTV Surveillance System has been designed to oversee crucial entry and exit points in Gir. Modern cameras equipped with Automatic Number Plate Recognition (ANPR) technology have been strategically placed at various checkpoints to facilitate real-time monitoring of both vehicles and individuals.



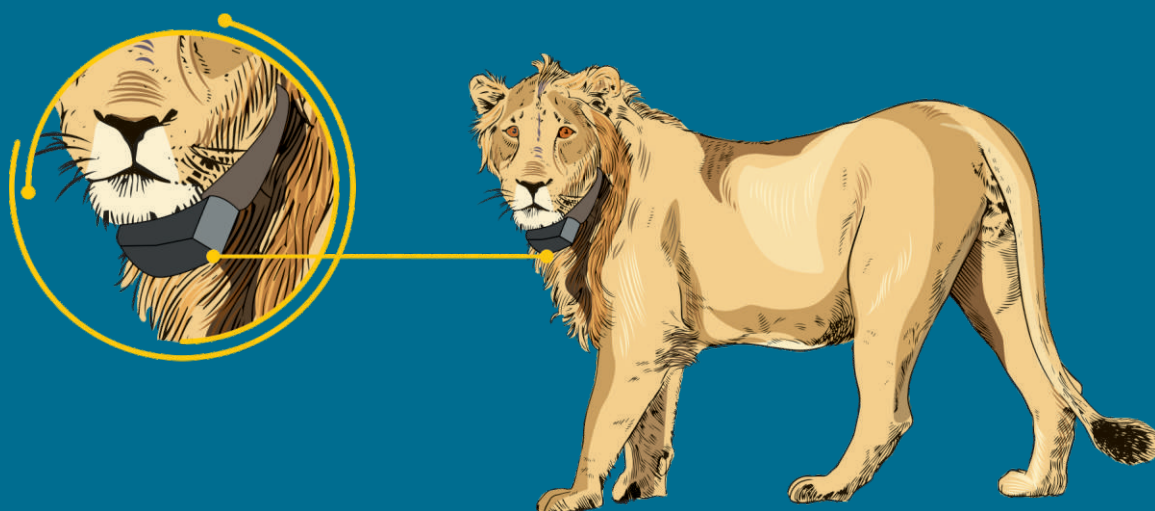
The CCTV footage provides immediate oversight, while archived data serves as a valuable resource for issue resolution and in-depth analysis, supporting the conservation and management.



## Carnivore Telemetry: Revolutionizing Conservation through Scientific Monitoring

In a pioneering effort within the nation, the Gujarat Forest Department has taken significant strides toward conserving Asiatic lions through advanced scientific monitoring and management. This ground-breaking initiative saw procuring and deploying seventy-five satellite radio-collars, sourced from Germany, on selected individuals. These radio-collars enable the systematic data collection about the Asiatic lion in the landscape.

Indian leopards have also been deployed with radio-collars to facilitate their monitoring and scientific management. The carnivore telemetry system closely tracks the movements of these radio-collared individuals. The data thus recorded is meticulously retrieved and analyzed to inform necessary management interventions and advance scientific research.



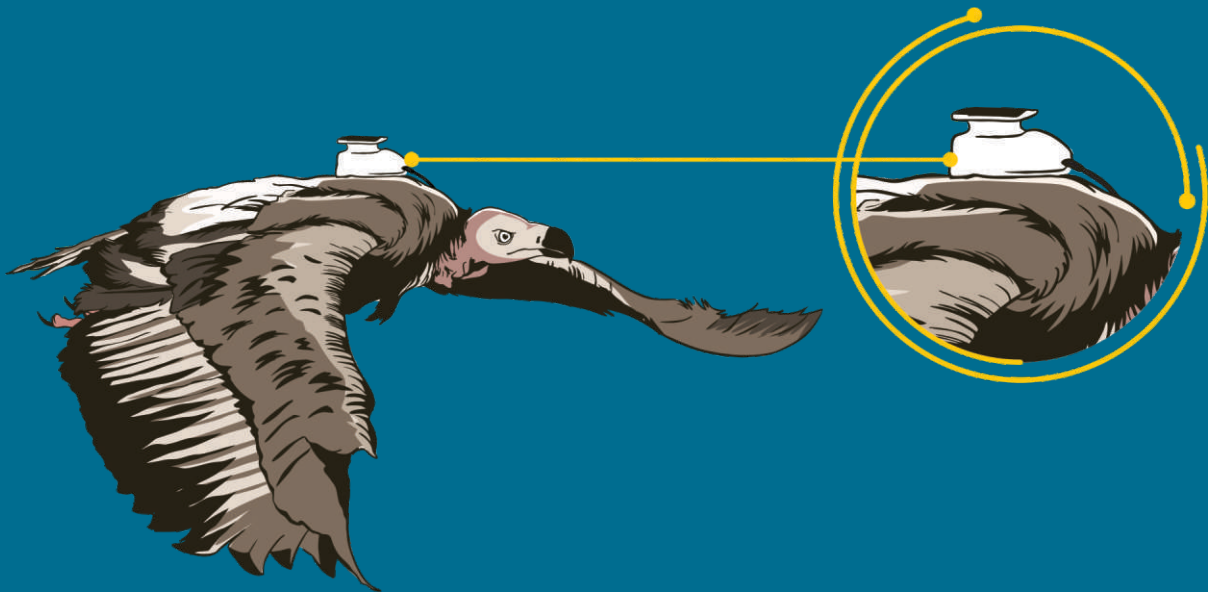
This comprehensive system has been designed to deepen the understanding of the ecology of the Asiatic lion and the Indian leopard. It provides critical scientific insights into various aspects, including spatial distribution, corridor mapping and utilization, movements and distribution of satellite populations, seasonal migration patterns, land use patterns, habitat preferences, and activity patterns. Moreover, it aids in addressing the intricate management challenges faced in the landscape.

The system's responsiveness is further enhanced through sensitivity-based alert mechanisms, ensuring that concerned field staff receive timely notifications, thus helping to prevent unforeseen situations. Furthermore, implementing advanced virtual geofencing in potential conflict zones enables real-time monitoring of individual movements.

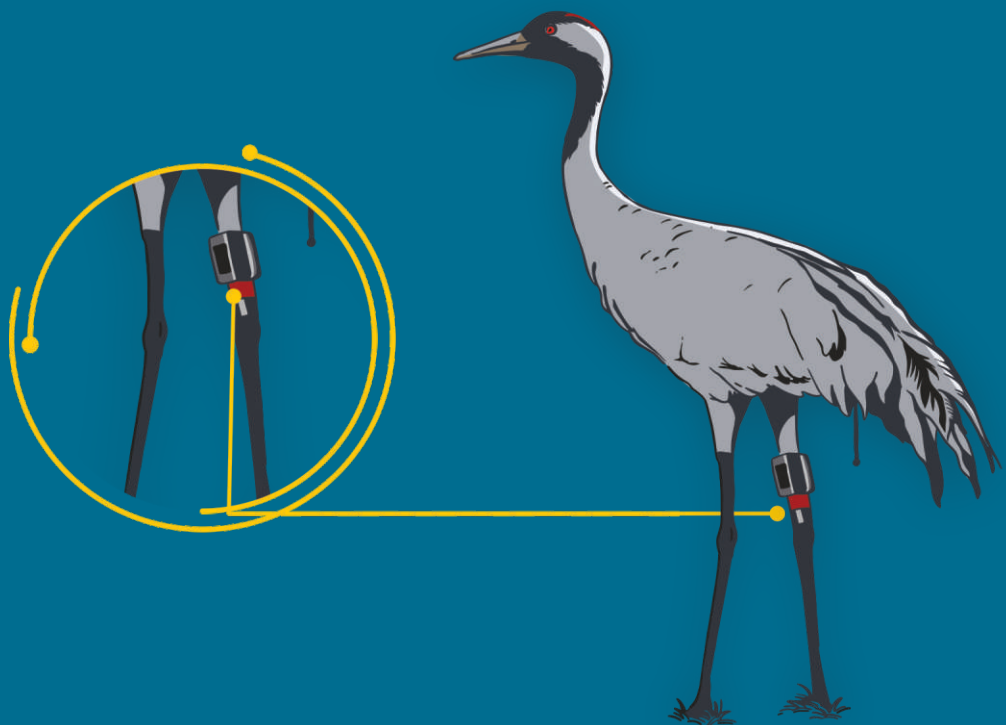
Therefore, this scientific endeavour enriches our understanding of the species' ecology and serves as a proactive measure to mitigate unforeseen challenges. Its implications extend to the formulation of future conservation and management strategies within the landscape, marking a significant leap forward in the pursuit of wildlife conservation and management.

## Avian Telemetry: Advancing Understanding of Bird Species

The avian telemetry system is a cutting-edge technology that monitors solar-powered transmitters deployed on 16 bird species in the landscape. This technology-driven scientific initiative focuses on avifauna and aims to enhance our understanding of the species.



The initiative covers a diverse array of bird species, including vultures (twelve individuals from six species), eagles (three individuals from three species), harriers (three individuals from two species), common and demoiselle cranes (four individuals), lesser florican (twelve individuals), lesser flamingo (four individuals), and Indian grey hornbill (eleven individuals). This initiative sheds light on various aspects of these birds' ecology by collecting scientific data & information.







The data obtained provides valuable insights into migration patterns, dispersal and foraging habits, wintering and breeding grounds identification, preferred habitats, and other previously unknown aspects of these species. The findings enhance our understanding and help shape future conservation and management strategies.

## Alert Generation System: Helping the Field Staff in Management

The Alert Generation System is a crucial tool for frontline staff, delivering timely information and facilitating streamlined field management. It systematically generates alerts and promptly communicates them to the relevant field personnel for immediate on-site verification. After confirming the situation, the field staff relay their findings to the Gir Hi-Tech Monitoring Unit.

These alerts are systematically categorized based on individual movement patterns, ranging from restricted to long distances. Specific categories include those approaching human habitations to prevent conflicts, those in proximity to linear infrastructure, wildlife with highly restricted movements due to littering or threats outside forested areas, and long-ranging individuals extensively traversing the landscapes to minimize conflicts and wildlife casualties. Alerts are also issued to address mortality events, ensuring timely ground assessment.



This system plays a pivotal role in mitigating human-wildlife conflicts, reducing wildlife mortalities, and addressing various challenges associated with wildlife movement within the landscape. Furthermore, conducting trend analysis on the alerts provides valuable insights for long-term wildlife management, enabling proactive planning and advisory transmission to field personnel.

## E-GujForest: Advancing Forest Management through Technology

The Gujarat Forest Department has pioneered the development of a state-of-the-art Forest Management Information System (FMIS) known as E-GujForest. This innovative system is accessible through an android-based application, thoughtfully designed to accommodate both Gujarati and English languages. To facilitate its use, 2000 mobile tablets have been distributed to field staff in the landscape, and the application can also be installed on their mobile devices.

E-GujForest boasts an intuitive Graphical User Interface (GUI) and includes features for capturing and storing images. It serves as a comprehensive platform for recording a wide range of data, encompassing forest-related offences, rescue and release operations, administrative notes, management interventions, incidents of kills and injuries involving both humans and wildlife, beneficiary-oriented schemes, as well as wildlife and other observations. Notably, the data can be stored offline, ensuring that it remains accessible even in areas lacking a GSM network. Once connectivity is re-established, the stored data is seamlessly synchronized and transmitted.

The system is seamlessly integrated with a Geographical Information System (GIS) interface, enhancing its functionality by enabling the mapping of various observations. This integration simplifies data processing and significantly contributes to formulating more effective protection and management strategies within the landscape.

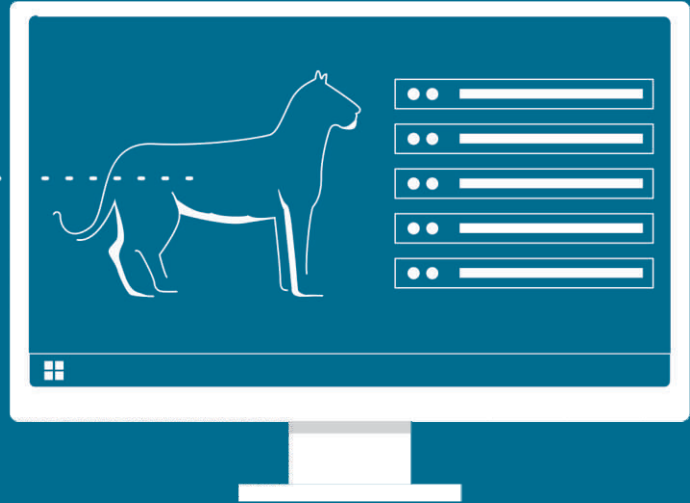
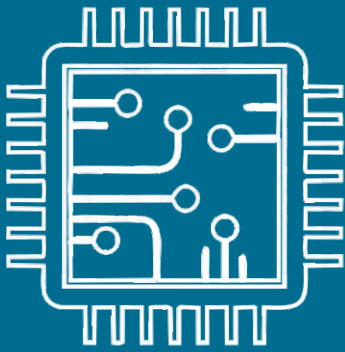


## Microchip Database: Augmenting the Individual Identification

Each captured or rescued individual, whether Asiatic lions or Indian leopards, undergoes a process of microchip implantation. The microchips are uniquely numbered (numeric or Alpha-numeric) and non-pathogenic and are inserted subcutaneously within the individual's body, providing a permanent identification solution throughout their lifetime.

The records of these microchip-implanted individuals are meticulously maintained in the Microchip Database System. This database serves as a valuable resource, facilitating the monitoring and tracking of these individuals. It offers critical insights into their capture and recapture history, case histories, progenies, and individual identification.





The array of information within this extensive database also holds significant implications for mitigating human-wildlife conflicts in the landscape. It contributes to the effective management and understanding of interactions between humans and wildlife, aiding in developing strategies to foster wildlife conservation and coexistence.

## Wireless Communication System: Strengthening Connectivity in the Landscape

A specialized wireless communication system has been meticulously established to ensure seamless connectivity in the landscape. This system provides the field staff with digital hand-held radio sets and fixed vehicle sets. Repeater stations have been strategically installed to extend the reach of communication across the rugged and remote terrains of the forests. These repeater stations receive signals and retransmit them, effectively covering long distances in the forest interiors.

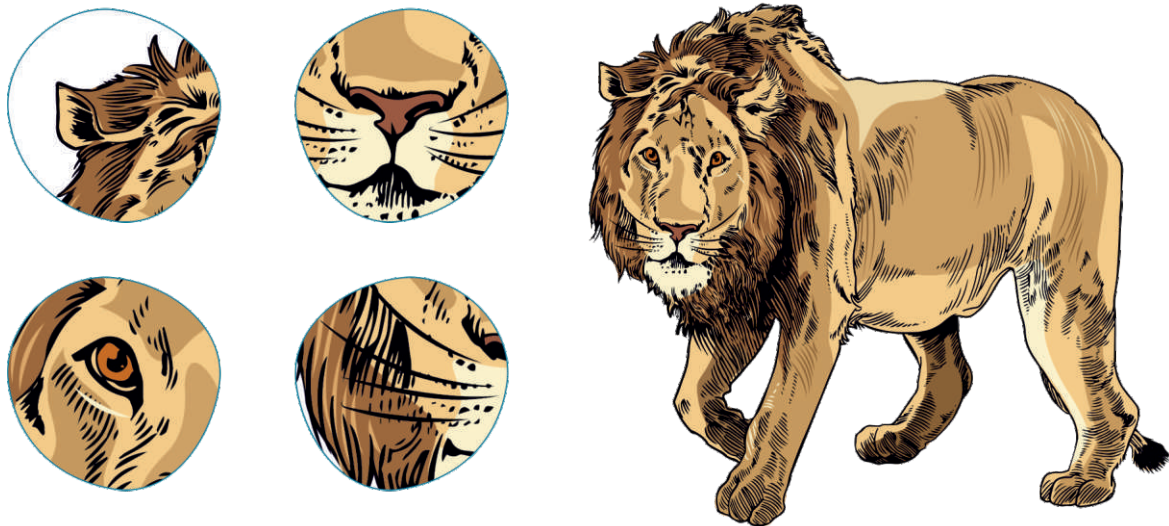


This cutting-edge wireless technology has not only facilitated communication in challenging geographical areas but has also introduced features such as closed groups and designated colour codes for different wireless sets. These enhancements have reinforced communication capabilities and further fortified the presence of field staff in the landscape.

## SIMBA: Revolutionizing Lion Identification

Technological advancements are pivotal in enhancing the identification of individual Asiatic lions, a species lacking distinctive colouration patterns or readily visible permanent marks for differentiation.

However, these lions possess a conspicuous and unique feature: parallel rows of whisker spots on either side of their muzzle, known as the vibrissae pattern. Each whisker spot corresponds to a small, furless area surrounding a single whisker. Scientific research has revealed that the patterns of these whisker spots are highly variable and generally remain consistent over time.



Recognizing the potential of computer-assisted photo-identification in understanding population demographics, dispersal patterns, and social behaviour and furthering conservation and management efforts, an Artificial Intelligence (AI)-based software called SIMBA has been developed. SIMBA employs deep machine learning techniques to automatically identify individuals based on the variability in their whisker spot patterns, as well as the presence of facial scars, ear notches, and other metadata.

This software excels in its ability to match point-patterns for pairwise comparisons, thereby streamlining individual identification. It creates a comprehensive database, assigning each lion a unique identification number.

SIMBA offers an intuitive user interface with search filters that include gender, name, microchip number, life status, etc. Furthermore, it allows for incorporating wildlife veterinary records into the database.

## Geographic Information Systems (GIS) Cell: Empowering Informed Decision-Making

The GIS Cell serves as a crucial hub for integrating and analyzing data collected in the landscape, utilizing potent analytical tools to empower managers with informed decisions and a deeper understanding of the intricate ecosystem dynamics. To carry out these tasks, ArcMap and open-source software like QGIS are employed for data analysis, mapping, and generating field-ready maps.



The analyzed data is then transformed into easy formats for field staff, ensuring accessibility and practicality in the field. The applications of GIS within this context are wide-ranging and encompass sensitive area mapping, patrolling route optimization and effectiveness assessment, habitat mapping, corridor delineation, species distribution modelling, wildlife tracking, ecotourism management, fire mapping and mitigation, water hole mapping, invasive species mapping, land use land cover mapping and planning, conservation area prioritization, law enforcement, and public awareness initiatives, among others.

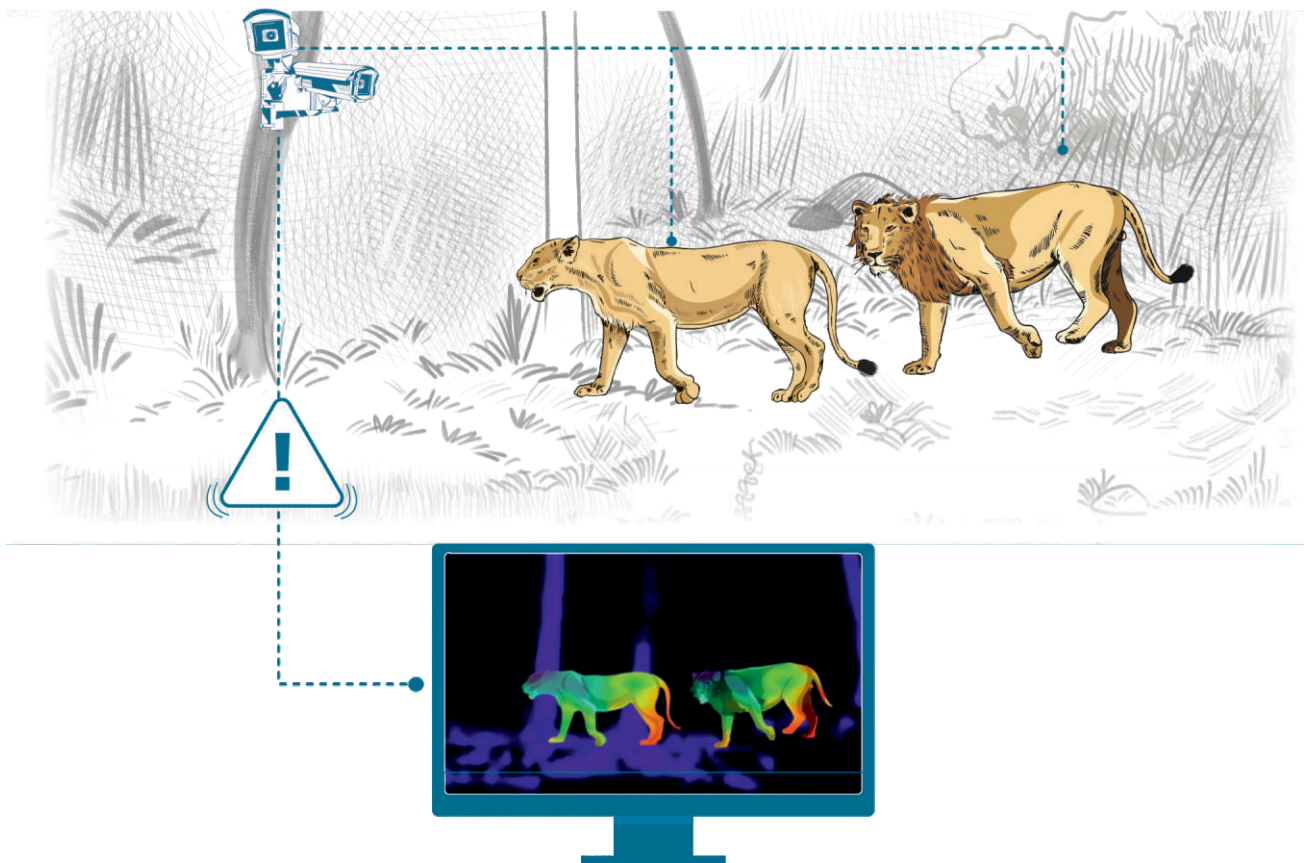


## Gir Speed Monitoring System: Enhancing Road Safety

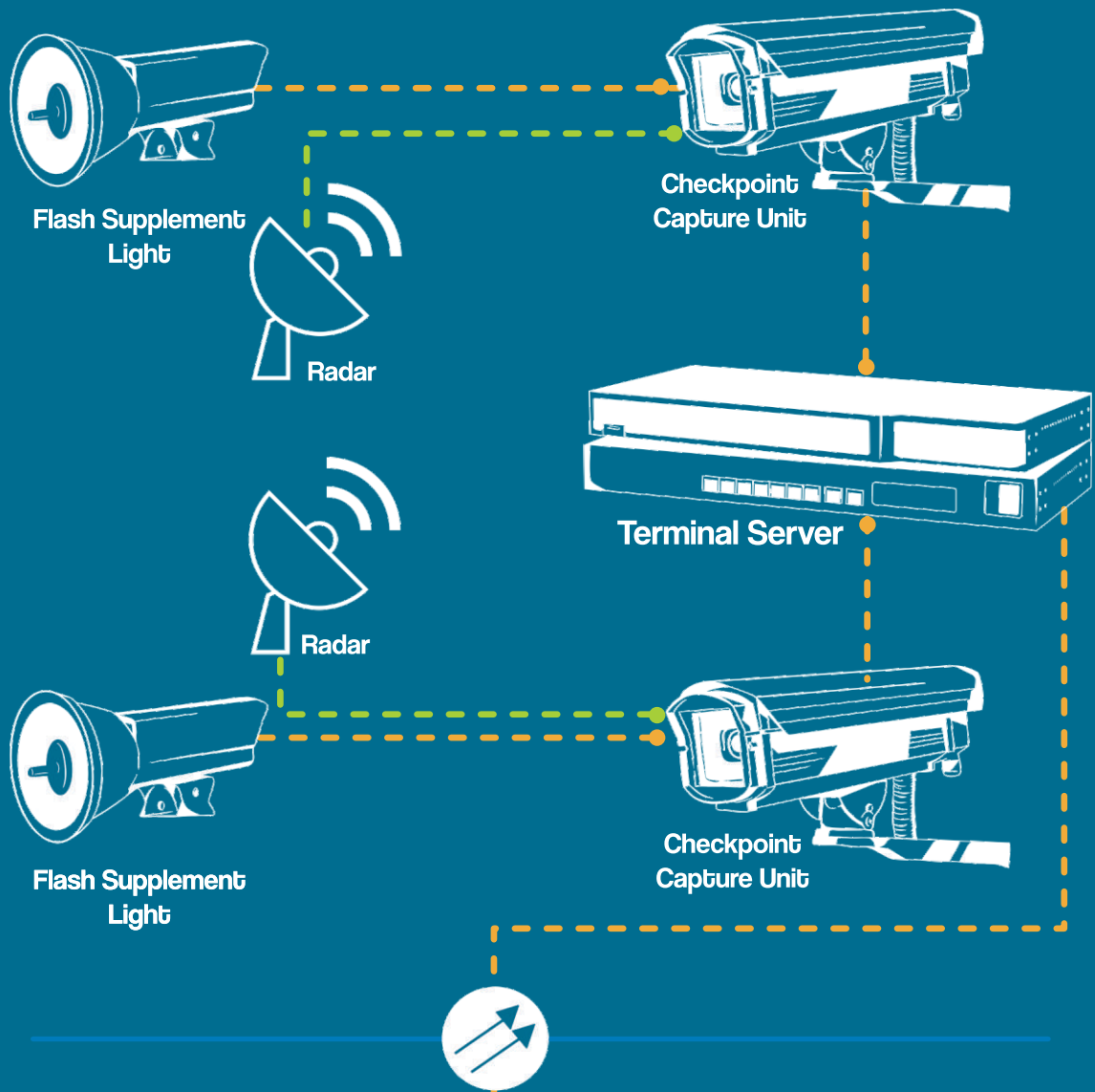
In recent years, integrating advanced technologies into traffic management systems has become crucial for improving road safety. One particularly important focus is addressing accidents caused by speeding vehicles, especially in areas where roads pass through or near protected areas with significant wildlife movements.

Combining sensor-based speed monitoring systems with Automatic Number Plate Recognition (ANPR) and thermal camera technology offers a promising solution to tackle this challenge. The Gir Speed Monitoring System uses various sensors such as radar or LiDAR positioned along the road network to detect vehicles and accurately measure their speed as they pass by. This information is then displayed on LED displays to alert drivers about their speed. ANPR technology automatically reads and interprets license plate numbers of passing vehicles, facilitating vehicle identification – an essential aspect for law enforcement and traffic violation tracking. Thermal cameras detect heat signatures emitted by objects, including wildlife and vehicles. Integrating this technology enables the identification of wildlife movement, even in low-light conditions and adverse weather.

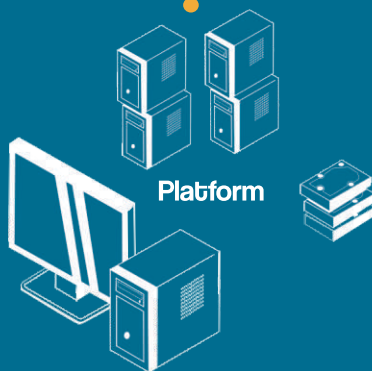
The system generates real-time alerts when speeding vehicles or wildlife movements are detected. These alerts contain important information, such as vehicle details or wildlife presence, and are promptly transmitted to the control centre or forest checkposts via secure communication channels. The system helps prevent wildlife accidents on sensitive roads and enhances road safety in Gir.



## Required equipment for onsite installation (Front end)

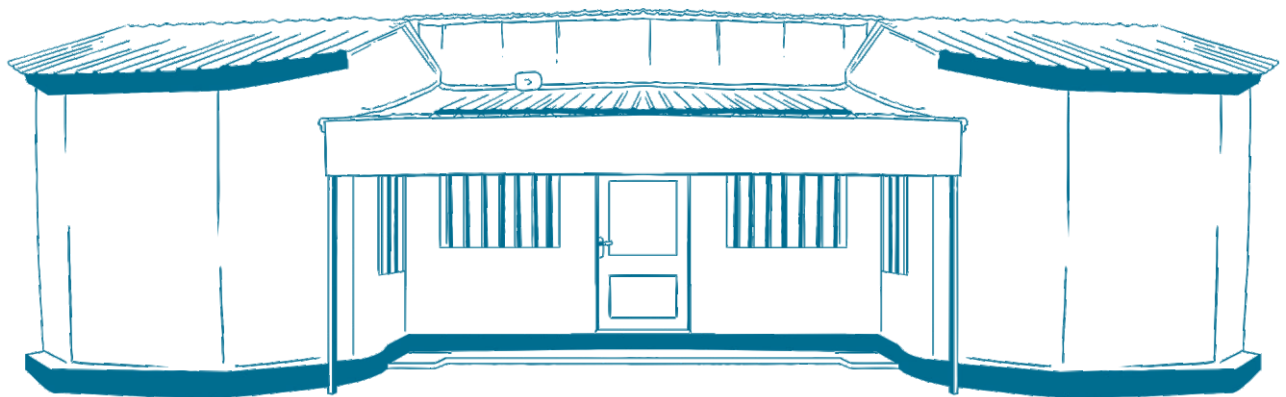


## Server System (Back end)



## Gir Hi-Tech Unit: Unified Box for Researchers

The Unified Box for Researchers functions as a comprehensive resource hub, consolidating various tools and materials essential for wildlife researchers. It encompasses wildlife research-related data, data analysis tools, licensed software, GIS software, plotters, and drafting tools for research documents. The convenience of having all these resources readily accessible in one place enhances research efficiency, ultimately saving valuable time.





Moreover, the unit hosts extensive scientific literature related to the landscape, providing researchers with a deeper understanding of existing research endeavours. Additionally, the unit operates 24/7, enabling researchers to work at their convenience based on their availability.

This centralized hub not only streamlines the research process but also empowers researchers with a wealth of knowledge and resources, thereby contributing to more effective and flexible research practices.

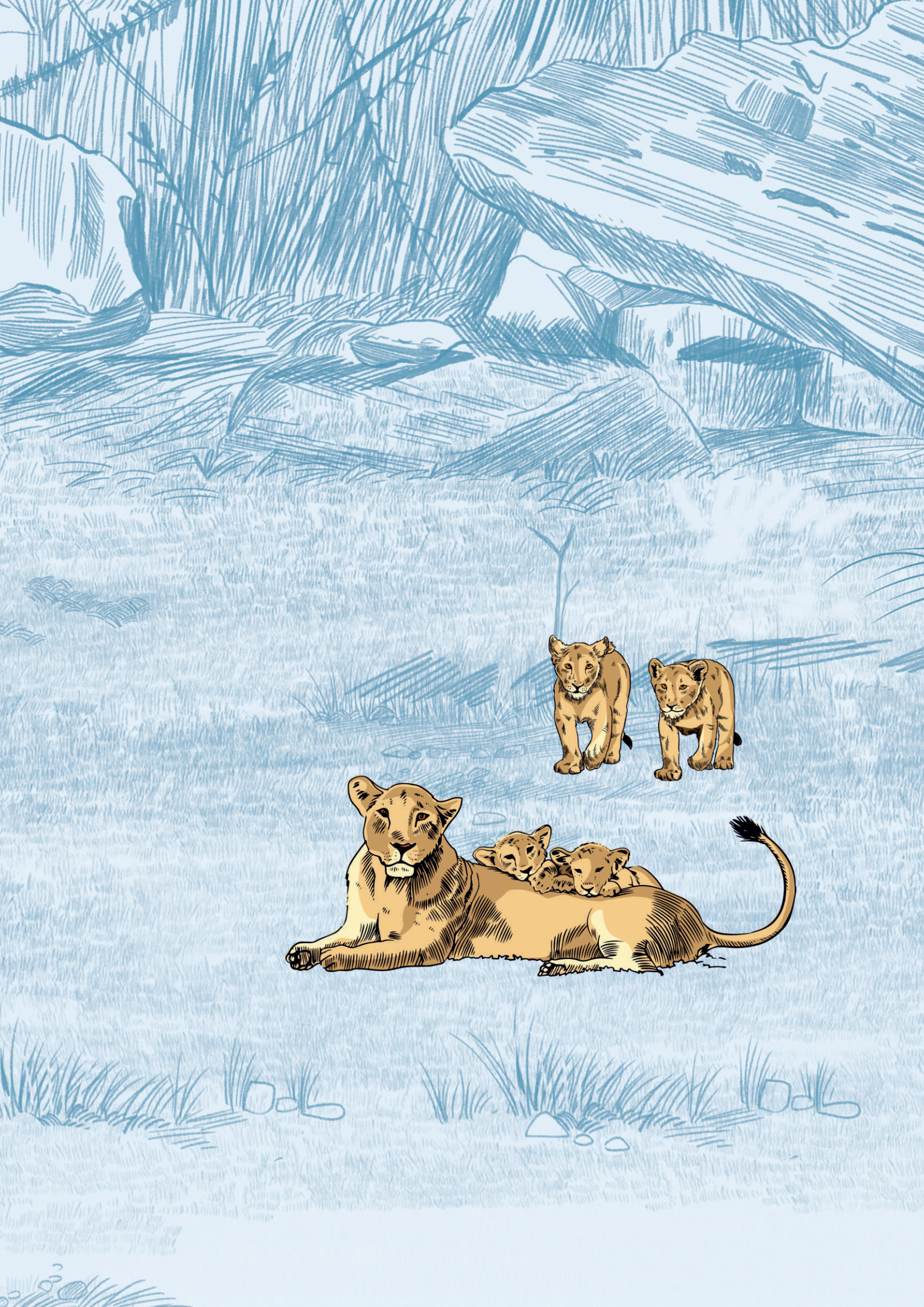
The Gir Hi-Tech Monitoring Unit, envisaged with the vision of scientifically monitoring the landscape from managerial, protective, and scientific viewpoints, has unequivocally demonstrated its efficacy.

It serves as a beacon, showcasing the exemplary integration of modern tools and technologies in the conservation and management of forests and wildlife in the Asiatic Lion Landscape.











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