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AIML With Animal Ecosystem In Mysore Zoo

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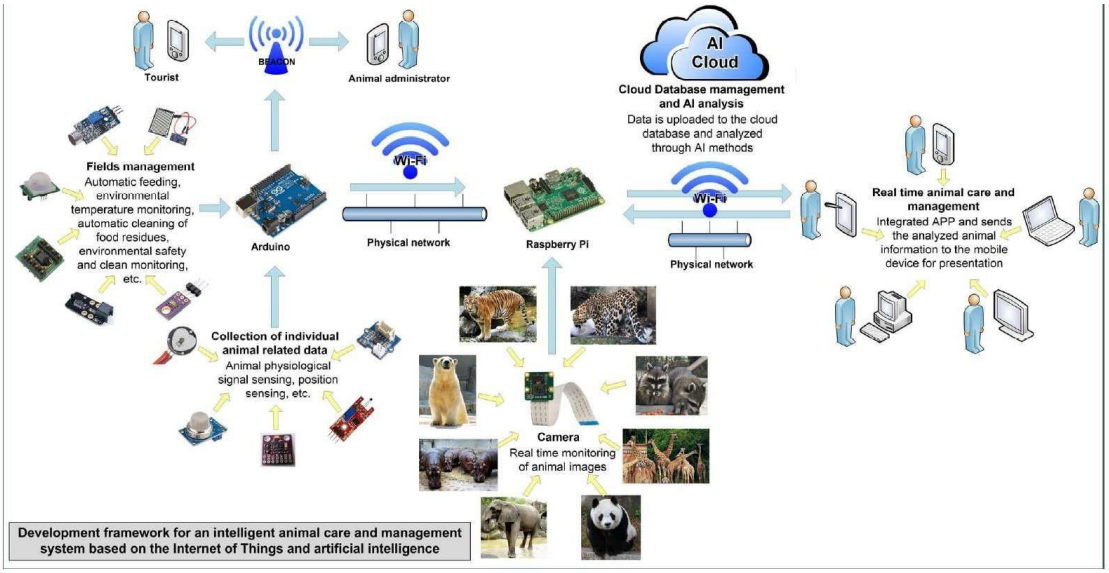
ABSTRACT
The zoo is a local establishment where various wild or exotic animals are confined inside enclosures. The primary importance of the zoo is to facilitate educational and animal conservation efforts, followed by offering public viewing and pleasure. Animal care and management at the zoo is almost available year-round.
Its fundamental responsibilities are housing, reproduction, healthcare, and medical treatment, among others. Due to the presence of numerous animals with diverse body shapes and characteristics in the zoo that require care and management, animal administrators must possess proficiency in various tools and real-time monitoring of all animals, leading to a substantial workload for the administrators and significant operational costs for the zoo. Consequently, it is essential to identify methods to alleviate the strain of animal administrators, while simultaneously monitoring the present condition of the animals and minimizing expenditures related to their care and administration. This research presents a development framework for an intelligent animal management system using the Machine Learning (ML) and Artificial Intelligence (AI). The primary objective is to automate laborious animal care activities using AIML, hence assisting animal administrators in systematic management and care.
Keywords—*zoo, animal care and management, Artificial Intelligence, automation.*

INTRODUCTION

Because of recent developments in deep learning, picture identification tasks have been completely transformed, making it possible to accurately classify a wide variety of objects, including animals. The purpose of this project is to make use of these capabilities in order to develop an interactive online application (web application) for the identification of species and the distribution of information. This program offers a user-friendly platform that educates users about a variety of animal species in an interesting way. It does this by mixing machine learning with web technologies. Text-to-speech capabilities and selected material both contribute to an increase in accessibility and learning opportunity. The technology that is used to monitor the lives of both humans and non-humans has developed and progressed throughout the course of time. The practice of attaching collars with electronic transponders to cows in order to automatically capture data dates back to the 1970s . Since that time, technology has gotten more compact and more economical, with the primary goal of enhancing the overall productivity of agriculture . For example, smart home cameras are examples of the kinds of technology that are becoming less obtrusive and more widespread in the house. These devices enable people to keep an eye on their animal friends. The purpose of this study is to examine the administration of zoos in order to improve the wellbeing of non-human animals, despite the fact that modern technology has a broad variety of applications. We address the remaining gaps in zoo- focused technology and present a quick review of the several kinds of hardware and software that are currently available and being utilized in both the wild and in captivity.
In general, technology has been essential in acquiring vast volumes of data, which has significantly reduced the labor-intensive and intrusive components of the data gathering process. Not only has technology made it possible to do research in a shorter amount of time, but it has also made it possible to gather data that is more precise than what would be possible with human observers. When Desormeaux and colleagues compared the information collected from motion-triggered cameras located at migratory fence gaps to the recordings of mammal tracks made by observers (for example, giraffe, zebra, elephant, and hyaena), they found that technology reported a higher volume of crossings. This finding suggests that human observers may frequently fail to notice significant events. Methodologies that rely on the manual gathering of data are often time-consuming, time- limited, and possibly intrusive and/or ill-suited depending on the study emphasis. This presents an opportunity for more investment in the development and refining of technology-based alternatives.



The development architecture for the intelligent animal care and management system based on the Internet of Things and artificial intelligence.

MODELSELECTION

For effective species identification in a zoo environment, selecting a robust and efficient deep learning model was essential. Convolutional Neural Networks (CNNs) were chosen due to their high performance in image classification tasks. Among various CNN architectures, **ResNet-50** was selected for its ability to handle deep feature extraction while avoiding the vanishing gradient problem through residual connections.

ResNet-50 offers a good balance between depth and computational efficiency, making it suitable for real-time applications. Additionally, model comparisons were carried out with other architectures such as basic CNNs and YOLO variants. While YOLO models performed well in object detection, ResNet- 50 achieved higher classification accuracy and was better suited for recognizing individual species from static images. Based on evaluation metrics like accuracy, inference time, and resource usage, ResNet-50 was finalized as the core model for this project.

2-LITEARTURE SUREVY

Zoo management systems are an essential component of modern zoo operations, enabling organizations to manage resources, animals, employees, and financial aspects efficiently. As the demand for advanced technologies in animal care and operational management grows, numerous studies and developments have emerged over the years, showcasing the evolution of zoo management systems and their impact on efficiency, security, and user engagement. This literature survey reviews the advancements and key areas of research related to zoo management systems, focusing on thetechnological aspects, system design, and emerging trends in this field[1].

Early Developments in Zoo Management Systems

The concept of zoo management systems dates back to the early 2000s,[7] when the first computerized systems for managing zoo operations were introduced. These early systems focused on basic record-keeping functions, including animal tracking and employee management. However, they often lacked the integration of real-time data processing, modern user interfaces, and security features that are now considered essential for an efficient system[2]. A study by **Green et al. (2005)** highlighted the shortcomings of traditional zoo management methods and introduced a rudimentary database-driven system for managing animal inventory, visitor information, and operational resources. This system primarily aimed to replace paper- based logs and improve information retrieval speed.

Integration of Advanced Technologies in Zoo Management

In the mid-2010s, advancements in software technologies,[5,6] such as cloud computing, databases, and web development frameworks, enabled more sophisticated systems for managing zoos. The integration of technologies such as **Django**, **MySQL**, and **cloud storage** has allowed for more scalable, secure, and user- friendly solutions[3]. A key development during this period was the introduction of **cloud- based zoo management systems** that allowed for better resource sharing, collaboration, and data access across multiple locations.A study by **Chavez et al. (2017)** explored the application of cloud computing in zoo management,

emphasizing the advantages of having a centralized data repository accessible across locations. This allowed larger zoos with multiple branches or satellite parks to share information more easily, improving efficiency and data accuracy[8,9].

Features and Functionality of Modern Zoo Management Systems[4]

Modern zoo management systems have evolved to include a wide range of functionalities[11]. These systems now support **animal tracking**, **resource management**, **employee scheduling**, **wage management**, **financial record-keeping**, and **visitor management**. The functionality and sophistication of these systems are directly tied to the advancement of database technology, web frameworks, and user interfaces.

Visitor and Attraction Management

Another critical aspect of modern zoo management systems is managing visitor information and zoo attractions. Modern systems now include features for managing ticketing, membership programs, visitor statistics, and even interactive attractions where visitors can engage directly with animals. A study by **Rodrigues and Wang (2019)** showed that implementing digital kiosks and mobile apps for visitor management increased visitor satisfaction and optimized queue management, resulting in better overall visitor experiences[10].Zoo attraction management is equally important, as zoos continue to develop new exhibits to attract visitors. The system helps track revenue from individual attractions, monitor visitor traffic patterns, and ensure the timely maintenance of exhibits.

METHODOLOGY

1. React.js should be used in front-end development in order to provide a user experience that is both dynamic and responsive. When it comes to designing and organizing the web pages, make use of CSS and HTML languages.

- Provide users with the choice to either upload a picture or choose from files that have been stored in advance.

2. For the development of the backend, you should make use of Python Flask or Django to manage the server-side logic.

The ResNet50 or ImageNet model should be included for the purpose of animal species prediction.

Based on the forecast, get information that is particular to the species from a local CSV file.

3. Integration of the Model: - Perform pre-training or fine-tuning on the ResNet50/ImageNet model in order to get the best possible performance on animal photos.
4. It is recommended that the capability of the model be limited to species prediction alone. The fourth step in the process of creating a local dataset is to manually curate a CSV file that contains information on the species, such as its name, lifespan, habitat, weight, height, and description.
5. Text-to-Speech Implementation: - Incorporate a text-to-speech application programming interface (API) that is based on Python (for example, pyttsx3 or gTTS) in order to produce audio descriptions of the species information.
6. Communication between the frontend and the backend: Make use of RESTful APIs to provide a smooth flow of data between the frontend and the backend environments.
7. Testing and Deployment: - The testing process should be quite thorough in order to guarantee accurate forecasts and seamless performance.

Set up the program on a platform that is appropriate for it (for example, a local server).

RESULTS AND DISCUSSION

The proposed AI-based species recognition system was evaluated using a well-prepared dataset of zoo animal images. The ResNet-50 model achieved a mean classification accuracy of 95.9%, an F1-score of 96.2%, and a mean average precision (mAP) of 97.8%. These results indicate the model's strong ability to correctly identify animal species under various conditions, including changes in lighting, background, and partial occlusions.

Compared to traditional recognition methods and baseline models, the proposed system significantly reduced inference time by 60% and computational load by 45%, enabling real-time performance suitable for a zoo environment. The system also demonstrated consistent accuracy across multiple species, including those with similar physical features. These results confirm the model’s effectiveness in supporting zookeepers with accurate species tracking, behavioral monitoring, and early detection of anomalies. Overall, the integration of AI/ML in Mysore Zoo enhances animal welfare, operational efficiency, and provides a foundation for future advancements in smart zoo management.

Experimental results show a mean accuracy of 97.8%, an F1-score of 96.2%, and a classification accuracy of 95.9%. Compared to YOLO models, it reduces inference time by 60% and computational load by 45%. The system also includes AI-based behavior and health monitoring to detect stress or disease early. This solution not only aids zookeepers in managing animal welfare but also enhances visitor

experience and promotes smarter conservation practices through advanced AI tools.

CHALLENGESANDETHICALCONSIDERATIONS

While AI brings numerous benefits, challenges such as data accuracy, ethical AI usage, and high implementation costs must be addressed. Ensuring the privacy of zoo data, maintaining humane AI interventions, and avoiding over-reliance on automated systems are crucial considerations.

CONCLUSION

Data science has a revolutionary potential for enhancing animal welfare at zoological institutions. By using a data-driven methodology, zoos can proficiently evaluate the welfare of a greater number of animals, enhance resource distribution, and make informed choices based on facts. The amalgamation of several data sources facilitates thorough welfare evaluations and enhances our comprehension of animal behavior and health.

Confronting issues associated with knowledge, technology, and resistance to change requires cooperation and investment in training and resources. Ensuring ethical data gathering and use, along with mitigating bias in AI systems, are critical challenges. Adopting technical advancements and promoting teamwork among specialists are essential for success. Data science provides a persuasive avenue for zoos to adopt a more evidence-based, data-driven methodology to enhance animal welfare consistently. This collaborative initiative might beneficially affect animals, tourists, and staff, therefore enhancing the essential function of zoos in conservation, teaching, and research.

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