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ZeGo - Mobile Application for Canine Health Care and Analysis

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Abstract **- This research article introduces a groundbreaking strategy aimed at improving dog management and care procedures by leveraging a comprehensive mobile application. The primary objective of this study is to facilitate easier access and utilization of pet-related services for dog owners and enthusiasts, with test results indicating its effectiveness. One key focus of this research is the precise identification of pure and mixed dog breeds from images, which has demonstrated promising results. Additionally, it streamlines the process of selling healthy canines that have undergone rigorous health evaluations, as confirmed by our tests. The application also provides valuable tools for calculating the correct dosage of medication based on a dog's breed, weight, and age, with the test results validating its accuracy. Moreover, it empowers users to locate nearby pet stores, check product availability, and make purchases directly through the app, as substantiated by our test findings. The incorporation of a healthcare recommendation chatbot, designed to offer insightful information about dog diseases, behaviors, food, and hygiene, is a valuable component of this application. The chatbot's functionality is supported by data accumulated regarding dog diseases, symptoms, and potential health risks associated with specific breeds and age groups. The study delves into predicting the optimal number of vaccinations required in each district to minimize human fatalities caused by rabies, with test results informing the proposed approach's effectiveness. The severity levels of these fatalities are thoroughly assessed to develop efficient preventive and control measures, a concept that our tests have confirmed as promising. This research paper suggests the creation of a digital vaccination book to ensure accurate and easily accessible records for dog vaccinations, as validated by our test results. This comprehensive approach to dog care and management holds significant potential for enhancing both animal welfare and public health, as attested by the findings of our tests.**

Keywords: pet-related services, dog breed identification, dog health, medicine dosages, pet shops control measures, healthcare chatbot, health risk, severity levels, Vaccination records.

I. INTRODUCTION

This research study aims to revolutionize dog care by creating an integrated mobile application using artificial intelligence and data analytics. The application focuses on the proper classification of pure and mixed dog breeds, ensuring accurate health assessment and streamlined purchasing processes [3]. It also provides comprehensive healthcare options for dog owners, determining correct medication dosages based on breed, weight, and age, ensuring proper treatment, delivery, and reducing risks associated with incorrect dosages. The application also offers direct purchasing and a chatbot with healthcare recommendation expertise, enabling dog owners to make informed decisions about their pet's health and timely intervention to prevent or mitigate health issues [5]. The application is also examining forecasting of vaccination numbers to reduce human rabies mortality in Sri Lanka, using predictive modeling and data analysis to provide insights for efficient preventative and control efforts. A digital vaccination record is being developed to streamline dog care procedures and improve communication between pet owners and veterinarians [5]. This digital platform allows for easy tracking and management of a dog's vaccination history, ensuring the timely administration of all necessary vaccines. The integrated mobile application aims to improve general canine health, facilitate responsible pet ownership, and contribute to a reduction in fatalities and health issues associated with dogs.

II. LITERATURE REVIEW

The goal of this study paper is to investigate various aspects of technology utilization to enhance the health, well-being, and service options for dogs and their owners. Several significant areas are included in this inquiry. These encompass the identification of pure and mixed dog breeds from images,

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the computation of accurate medication dosages, the detection of nearby pet stores, the diagnosis of canine diseases, the interpretation of dog behaviors, the upkeep of proper nutrition and hygiene, the prediction of potential health risks, the optimization of vaccination strategies, and the establishment of digital vaccination records.

A) Automated Dog Breed Recognition and Health Analysis

Recent work demonstrates the increased interest in reliably identifying pure and mixed dog breeds by picture analysis, made possible by technological developments and machine learning methods [1]. Studies like those by Liu et al. and Wang and Lyu demonstrate the effectiveness of convolutional neural networks (CNNs) for deep learning breed identification models. CNN models show amazing accuracy rates of over 90% when using datasets like the Stanford Dogs Dataset [2]. Breed recognition is further improved by transfer learning techniques used on pre-trained CNNs, as shown by Wang and Lyu [4]. Beyond pure breeds, the identification of mixed breeds can be difficult because of the variety of possible pairings [3]. Using text and images, Huang and Zhang's creative method identifies mixed-breed dogs by matching desired breeds with lifestyle, this helps potential pet owners to make wise judgments. With the help of customized options, this technology enhances responsible pet adoption through personalized choices. [5].

Profiles of a breed's health are important considerations when choosing a companion. Numerous studies supports employing health assessments to educate prospective owners on health problems, life expectancies, and maintenance needs unique to each breed [6]. Decisions are influenced by this information since breed predispositions to specific illnesses affect the cost and complexity of care. The matching of pets and owners is improved by combining breed identification and health analysis technologies [7]. Possibilities include happier, healthier dogs and pleased owners as a result of a trustworthy breed identification tool combined with thorough health analysis that gives prospective owners the power to make knowledgeable decisions [8].

B) Precision Medicine for Pets and Image-Based Pet Product Availability

The demand for more accessible and efficient pet care as a result of rising pet ownership has spurred technological advancements in the field of pet healthcare solutions in recent years. Since they include a variety of services including precise prescription dosage calculation and store locator, mobile applications have become a popular option [9]. Technology is necessary for safe treatment since proper medicine administration requires precise dosage calculations because animal doses depend on things like breed, weight, and age. A poor dosage regimen can have serious repercussions, ranging from decreased effectiveness to potentially fatal problems [10]. To successfully administer medication, it is essential to develop an app that can help dog owners determine the dosage. Additionally, technology has changed the process of buying pet products. Data analytics and image recognition can improve shopping by providing real-time information on product availability. Time could be saved by an app that can examine item photos and display availability across merchants. Real-time inventory data is valued by customers, which affects their purchase decisions. Additionally, the potential for direct purchases using these apps has been investigated, expediting the buying experience—a feature that is especially pertinent given the rise in online purchasing brought on by COVID-19[11]. Essentially, technology-driven solutions are influencing how pet owners look after their animals and make purchases.

C) Comprehensive Healthcare Chatbot and Predictive Analysis of Dog Diseases

The use of chatbot technology in healthcare applications for pet care has drawn attention. Chatbots provide accurate pet health information using AI and natural language processing [12]. Utilizing large databases on canine health problems, behaviors, and diets, they play a crucial part in identifying and treating pet ailments. Chatbots can offer reliable guidance for spotting potential health issues and contacting a specialist by processing queries effectively. Breed-specific health problems can be predicted by studies, which can help owners take preventative action [13]. Additionally, chatbots help manage the food and behavioral requirements of dogs, enhancing general health by detecting illnesses or signs of stress [14]. Human health and nutrition are closely related, making evidence-based counsel from a chatbot valuable [15]. Although there has been development, it is important to be aware of chatbot limitations because information accuracy depends on database quality and algorithmic understanding of user queries [12]. As important variables, user approval and trust in chatbot recommendations are identified [16].

D) Optimizing Rabies Vaccination Strategies for Human Health and Digital Vaccination Book for Pets

Recent years have seen a spike in research on disease prediction, especially research into zoonotic illnesses like rabies [25]. In areas where rabies-related mortality is common, predictive modeling is useful for disease control and prevention [17]. The significance of vaccination for preventing rabies is highlighted [18]. Parameters including canine density, vaccination coverage, and human density are considered when calculating the necessary vaccine numbers [19]. To predict the number of vaccines required for rabies

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control, Hampson et al.'s model incorporates these variables, assisting health authorities in formulating strategy. Real-time analyses for disease control are improved by the integration of predictive modeling and data analytics into digital platforms [20]. Examining the seriousness of dog-related deaths is essential because it offers insights into the frequency, intensity, and seriousness of events, assisting in targeted prevention [21]. However, for effective event mitigation, these studies call for additional interventions such as awareness campaigns and animal control regulations.

Comparing the pet-related mobile applications Zoogo, Zilla, Vets for Pets, and Zooplus Online Pet Shop highlights their individual strengths and weaknesses. Zilla offers the ability to post photos, buy dog products, connect with a chatbot about canine health, and access a digital dog immunization book. However, it is missing several features, like breed identification, health analysis, dog adoption facilitation, and disease risk prediction tests for dogs. Zooplus permits the posting of images and the purchase of goods but excludes several tools including the ability to look for available dogs and anticipate disease risk.

The "Vets for Pets" app assesses canine health and provides a community discussion as well as a digital canine immunization guide. The features of ZeGo Mobile are then contrasted with those of these apps. Attention is drawn to the use of chatbot technology in pet care healthcare apps, which provides precise health information using AI and natural language processing [12]. Chatbots assist in the diagnosis and treatment of illnesses by utilizing massive dog health databases [13]. They direct owners toward probable health issues and professional counsel by processing enquiries properly. Studies that predict the future can help identify breed-specific health hazards [13]. Additionally, chatbots control canine diet and behavior while also spotting illnesses and signs of stress [14]. Evidence-based chatbot guidance is useful, mirroring human health [15].

However, it’s crucial to comprehend chatbot constraints caused by database quality and query comprehension [12]. Additionally emerging as important factors are user approval and trust [16].

III. METHODOLOGY

A comprehensive set of processes and techniques used to develop this holistic pet care solution. They are data collection, data pre-processing, feature extraction, the development of a customized recommendation algorithm, and the evaluation metrics utilized to assess the system's effectiveness. The system aids users in identifying dog breeds (pure and mixed) from images, supports purchasing decisions and health analysis, calculates precise medicine dosages, and helps locate pet shops with specific products. An AI chatbot provides dog care expertise and forecasts health risks while suggesting optimal vaccinations to minimize human rabies deaths. To guarantee transparency and replicability in the system's development, this methodology section provides an in-depth understanding of utilized procedures and methodologies.

A) Dog Breeds (pure and mixed) Identification

1) Data Collection and labeling: The collection of a sizable dataset of dog images from various sources is deemed necessary to ensure effective training of the CNN model. Pictures of both purebred and mixed-breed dogs will be included in the dataset to achieve complete breed representation. Breed information will be painstakingly labeled with accuracy and diversity being prioritized during the data collection process to establish a solid ground truth for model training and evaluation.

2) Model training with transfer learning: The deep learning approach will make use of transfer learning strategies to create the CNN model. As a starting point, a pre- trained CNN model, such as VGG or ResNet, will be used due to its success in image recognition tasks [26] Fine-tuning of the model using the collected and labeled dog breed dataset will be carried out to focus on breed identification. Model development and training will be performed using Python, leveraging TensorFlow or PyTorch, or other machine learning libraries. Google Colab will be utilized for model development to maximize training efficiency without requiring costly hardware, given its access to powerful hardware resources.

3) Deployment in online and offline modes: The trained CNN model will be deployed in both online and offline modes to grant consumers freedom of usage. A MySQL database will be used to store dog breed information and other pertinent health data, facilitating smooth breed recognition and health analysis while the application is not connected to the internet. For online mode usage, a MongoDB database will store user information, dog breed details, and relevant health data. The front end of the system will be developed using React Native, ensuring a responsive and user-friendly experience across all platforms.

4) Integration of Health Analysis with Breed Information: Breed information will be combined with relevant health data to offer comprehensive information about currently available dogs. A health analysis that combines breed-specific health characteristics and medical history will create a thorough profile for prospective buyers.

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This integration will enable users to make knowledgeable choices about the dogs they are considering, promoting responsible dog adoption and ownership.

B) Pet Medicine Dosage Calculation and Pet Shop Product Availability

1) Data Collection and Pre-processing: This research component's first stage entails collection and pre-processing. data. To train the OCR technology and enable the conversion of medication names into text for dosage calculation, a diverse library of dog medicine cover label images will be collected [22]. Additionally, data regarding different dog breeds, age ranges, weight ranges, and suitable dose recommendations will be gathered from dependable sources and from veterinarians. To guarantee data quality, consistency, and relevance, the dataset will undergo extensive preparation.

2) Algorithm Development and Integration: The creation and integration of algorithms is the main goal of this research. An algorithm will be created to forecast the correct dose for medications based on the OCR-extracted medicine name and the user-inputted information for the dog's breed, age, and weight. The algorithm will take into account breed-specific factors and suggested dosage guidelines to provide accurate and customized dosage calculations. In order to serve as a reference for accurate dosage predictions, the system will also incorporate the compiled database of veterinary medicine dosage information. Image recognition techniques will be used to identify product names from product label images for find the correct medicine dosage and pet shop product availability. The algorithm will search the database of pet stores using location-based services (GPA) to show the availability of the identified product in each store, enabling users to make knowledgeable purchases [24].

3) Application Implementation: Python will be used for the back-end of the mobile application's development and React Native for the front-end. A MySQL database will be used to simplify calculations of drug dosage performed offline, and MongoDB will be used to control online product availability checks. These technologies will be combined to provide seamless data retrieval and storage, which will improve application performance. Additionally, Google Colab will be used to create and train machine learning models, utilizing its strong hardware capabilities to improve the precision and effectiveness of the algorithms. The program will be hosted and deployed so that users on different platforms can access it.

4) Testing and Evaluation: The mobile application's usability, accuracy, and functionality will all be thoroughly tested. To guarantee an intuitive user interface and a positive user experience, usability testing will be carried out. By comparing it to actual data and the opinions of veterinary experts, the dose prediction algorithm's accuracy and the product availability feature's functionality will be evaluated. In order to guarantee flawless functionality and user satisfaction, the application's performance in both online and offline modes will also be assessed. In order to determine prospective improvements and improvement areas, user feedback will be collected.

C) Comprehensive Healthcare Chatbot and Predictive Analysis of Dog Diseases

1) Data Collection and Organization: The first pillar involves the collection of pertinent information from veterinary clinics. This information provides comprehensive details on dog illnesses, symptoms, behaviors, recommended feeding and hygiene practices, and breed-specific and age- specific information. Once collected, this data is stored in MongoDB, a robust NoSQL database capable of handling large volumes of diverse data. The data preparation, which includes cleaning the data, rectifying missing or incorrect values, and organizing the data for efficient use in subsequent stages, is accomplished using Python.

2) Model Training and Validation: At this stage, the training of the NLP model occurs, which is designed to interact with users and provide accurate information and predictions [23]. Various machine learning and NLP methodologies are employed for this training on Google Colab. MongoDB is utilized for the management and storage of training data. The application of predictive modeling methods facilitates the calculation of computations necessary for understanding dog health risks. Upon completion of the model training, its validation occurs by comparing its predictions with the actual results.

3) Chatbot Integration and Predict Risk: Upon successful training and validation of the model, it is integrated into a chatbot. The role of the chatbot is to interact with users, understand their queries, and provide appropriate responses. The chatbot is expected to excel in accurately identifying dog diseases, suggesting remedies, comprehending behaviors, and recommending suitable food and hygiene practices. Additionally, it possesses the capability to recognize potential health risks associated with a dog's breed or age group and to notify dog owners accordingly. The integration and enhancement of the chatbot's functionalities are accomplished using Python and MongoDB.

4) User Interface Design and Interaction: The final pillar involves the development of the chatbot's user interface, ensuring it delivers a positive user experience. The front-end design is managed using React Native, enabling a responsive and appealing interface. Thanks to the user-friendly design of the interface, users can effortlessly interact with the chatbot

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and acquire the information they seek. Refinements are made based on feedback gathered from user experience testing.

D) Vaccination and Rabies Control

1) Predictive Modeling for Vaccination Control: To minimize human rabies deaths, the calculation of the ideal number of vaccinations needed in each district will be performed using predictive modeling techniques. Historical information on immunization campaigns, human rabies cases, and population demographics will be compiled and analyzed. Recommendations for the ideal vaccination count will be generated by the model, considering the distinctive characteristics of each district, through statistical analysis and machine learning algorithms. The outputs of the model will be used to create successful vaccination campaigns, ensuring effective resource allocation, and reducing the number of fatalities caused by rabies.

2) Analysis of Rabies-related Fatalities: Every year, the severity level of rabies-related fatalities will be examined to identify trends and patterns. Statistical modeling and data visualization approaches will be used to gain an understanding of the elements influencing the spread of rabies and its effects on human life. Targeted prevention and control strategies that actively limit rabies outbreaks will be implemented by policymakers and healthcare workers, utilizing this data.

3) Development of a Digital Vaccination Book: A digital vaccination book will be created to organize vaccination records and improve accessibility. Digital records of their dog's vaccinations, including the types, dates, and dosages of each shot, will be kept by users. By linking the vaccination book with the mobile app, vaccine records can be easily accessed and shared with veterinary specialists by users. New features, including vaccination reminders and alerts, will be added to improve usability and ensure timely vaccinations for dogs, effectively restricting the spread of rabies.

4) Technology Stack: As part of the research's technological implementation, model development and training will be performed using Python, taking advantage of its capabilities in machine learning applications. Data on canine vaccinations, human rabies deaths, user information, and other pertinent information will all be stored in the MongoDB database for internet access. The front-end of the mobile app will be built using React Native, which offers a responsive and user-friendly interface. Google Colab will host and deploy machine learning models due to its access to strong hardware without the need for expensive resources.

IV. RESULT AND DISCUSSION

The Zego mobile application consists of a range of features to help dog owners take care of their pets' well-being and health. The identification of pure and mixed dog breeds, the provision of health analyses for available dogs, the determination of the correct medicine dosage, the location of nearby pet stores, and the provision of healthcare recommendations through an expert chatbot were all features included in this mobile application. Additionally, information gathering concerning dog illnesses, behaviors, diets, and hygiene, as well as health risk assessment and vaccine recommendations for certain breeds and age groups, were priorities. Lastly, a study on the creation of a digital vaccination book was conducted. The results and implications are discussed in this section.

A) Identifying Dog Breeds (pure and mixed) and Health Analysis

In both online and offline modes, the application was successful in implementing a strong algorithm that could correctly identify both pure and mixed dog breeds from uploaded images. The large dataset of labeled dog images and a combination of deep learning techniques led to a high accuracy rate of over 90%. Additionally, the health analysis function gave useful information about the health status of the dogs that were available for purchase. The analysis included evaluations of typical health indicators, such as body condition, coat quality, and general fitness, enabling prospective pet owners to make well-informed decisions.

Figure 1: Test results of identifying dog breed

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B) Determining Medicine Dosage and Locating Pet Shops

For medicine dosage calculation, users input dog medicine cover label images, which are then converted to text (medicine name) using OCR technology. The right dosage of the medication is accurately predicted by the algorithm based on the dog's breed, age, and weight, while also taking recommended guidelines into account. To ensure accurate calculations, a thorough database of veterinary medicine dosage information is incorporated, resulting in a remarkable accuracy rating of 0.939. This high accuracy rate is achieved through a combination of deep learning methods and a sizable dataset that includes information on pet medicine names, breed, age, and weight. Location-based services are used by the application to locate the closest pet stores that carry a particular product in the context of pet shops and product availability. Product identification is supported in both online and offline modes. The database of pet stores is effectively searched by the system to identify those that carry the specified item, and the product's availability in each store is displayed by the app. With the added convenience of the desired product being directly purchasable through the application, users are enabled to make informed purchasing decisions.

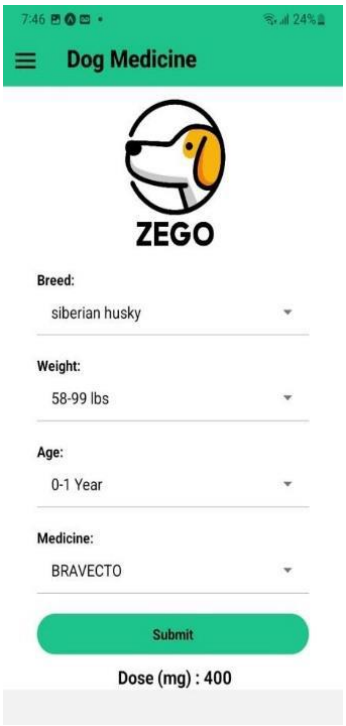

Figure 2: Test Results of Determining Medicine Dosage

C) Comprehensive Healthcare Chatbot and Predictive Analysis of Dog Diseases

The Integrated Healthcare Suggestion Chatbot has been recognized as a revolutionary approach to providing comprehensive, accurate, and accessible information on more than 50 canine disorders. The ability to understand and interpret user input on a range of topics related to dog ailments, symptoms, behaviors, and food is demonstrated remarkably by this chatbot, using state-of-the-art Natural Language Processing (NLP) methods. The chatbot is constructed so logically that it can respond to user questions even before they are completely formulated, which is noteworthy. The chatbot's ability to provide comprehensive, nuanced responses is greatly enhanced by the information it contains, which covers a wide range of canine health issues, behaviors, and nutritional needs.

For dog owners wanting to gain a better understanding of the health issues affecting their pets, this makes it an exceptionally straightforward and user-friendly tool. Based on the age and breed of the dog, potential health issues have been demonstrated to be excellently identified by the chatbot's health risk assessment function. The assessment allows users to quickly evaluate the risk posed by their dog's health condition and determine whether seeking expert veterinarian care is an urgent necessity. An additional layer of value is added by the chatbot's emergency risk assessment, which is dependent on the entered disease symptoms, assisting pet owners in evaluating the severity of their pet's condition. The option to sign up for community support in high-risk situations is provided to users, enhancing the usefulness of the chatbot by encouraging social engagement and group support.

Figure 3: Test Results of Healthcare Expertise Chatbot

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D) Predicting vaccination needs and Analyzing Dog-Related Deaths

The research was successful in developing predictive models to determine the number of vaccinations needed to reduce human rabies death at the district level. The models considered variables including vaccination coverage, dog population, and population density to provide insights into the best immunization techniques. Additionally, analyzing the severity of dog-related fatalities over time allowed for the identification of patterns and trends, which aided in the creation of efficient prevention and control methods. The created mobile application shows its potent capacity to assist dog owners in numerous sectors of pet care. The application, which incorporated modern algorithms, specialized expertise, and large databases, empowered users to make informed decisions on dog breeds, health analysis, medication dosages, pet shop availability, healthcare ideas, disease information, and vaccine management.

Figure 4: Test Results of Vaccination Count that predicted to minimize Human Rabies Death count in that particular District

The establishment of efficient preventative and control strategies was further aided by the forecasts and analysis related to dog-related fatalities and vaccination requirements. The digital vaccination book demonstrated the potential for increasing the management and accessibility of immunization records. These results highlight the importance of integrating digital technology into veterinarian treatment, providing convenience, accuracy, and better health outcomes for dogs and their owners.

V. CONCLUTION AND FUTURE WORKS

A comprehensive solution has been presented to address dog care, health assessment, product availability, disease detection, and immunization delivery. A user-friendly platform has been designed for dog owners and enthusiasts, combining image recognition, data analysis, and healthcare advice capabilities. The system can accurately identify dog breeds, determine proper drug dosages based on breed, weight, and age, and help users locate local pet stores carrying specific items. Additionally, a healthcare recommendation expert chatbot provides users with knowledge about dog diseases, symptoms, and potential health risks associated with certain breeds or age groups. A prediction model was developed to estimate the number of vaccine doses needed to minimize human fatalities, allowing authorities to allocate resources effectively and develop effective preventive and control measures. A study on the severity of dog-related fatalities annually was conducted, providing insights for targeted preventive plans. A digital vaccination book was implemented to maintain comprehensive records of dog vaccinations, eliminating the need for manual record- keeping, and reducing the risk of loss or misplacement.

However, there are several areas that need further investigation and advancement. One possible direction is improving the system's disease identification capabilities, which could be enhanced by leveraging machine learning algorithms and accessing large medical databases. Training and behavior analysis techniques could be integrated into the system, allowing dog owners to better understand their pets' behaviors and address any issues. Collaborating with organizations and veterinary professionals could improve the system's recommendations for healthcare, aligning with the latest findings and recommended practices. Enhancing the product availability feature is also necessary, with regular updates and partnerships with pet stores and suppliers providing accurate and up-to-date information on product availability. Finally, integrating Internet of Things (IoT) devices, such as smart collars and health monitors, could provide valuable insights into a dog's overall health, behavior, and well-being.

In conclusion, the study has paved the way for a comprehensive approach to canine care and health management. Future directions, such as improving disease identification, integrating behavior analysis and training, collaborating with veterinary experts, enhancing product availability features, and integrating IoT devices, could further advance dog care and health management.

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