

INDIAN INSTITUTE OF TECHNOLOGY, ROPAR



i-Scan

Ensuring Safety and Welfare of Animals

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(2021mcb1368)



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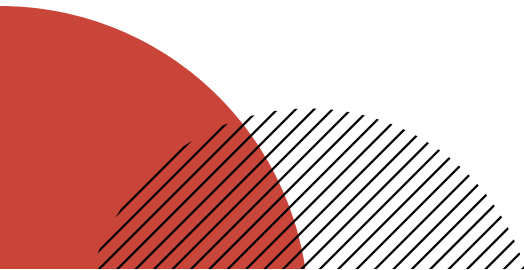
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INTRODUCTION AND OBJECTIVES

ABSTRACT

The i-Scan project aims to provide a solution for tracking and maintaining digitized information about the health and welfare of animals. The project was inspired by the stray dogs at IIT Ropar, and the Animal Welfare Committee of IIT Ropar and local veterinarians were consulted to address the issue of sterilization and vaccination markings.


i-Scan will enable the tracking of campus dogs and store digitized information such as owner's detail, color of the animal, estimated age, gender, territory, temper, medical history, sterilization, and vaccination status. The project has potential applications for pet owners, rescue centers, institutes with stray animals like IIT Ropar and pet stores to maintain important information about animals and their owners in case of loss.

The i-Scan project team has identified several tools and techniques that will be utilized during the project, including QR codes and facial recognition technology. The expected outcomes of the i-Scan project include improved animal welfare, reduced instances of lost animals, and increased awareness of animal welfare issues in the community. The i-Scan project represents a novel and innovative approach to animal welfare, utilizing modern technology to enhance the well-being of animals.

DEFINITION OF PROBLEM

The welfare of stray animals has been a persistent issue for communities worldwide. Unfortunately, the lack of proper tracking mechanisms and documentation makes it difficult for individuals and organizations to ensure that these animals receive adequate care and treatment. Current methods of marking animals for sterilization and vaccination are not only cruel but ineffective in tracking their medical history.

At IIT Ropar, the problem is more severe, with numerous stray dogs complicating the task of keeping track of their welfare and medical records. Without a centralized system, crucial information may be lost, leading to unnecessary pain and suffering for the animals.



The i-Scan project has been created to address this problem by providing a centralized system for tracking and maintaining digital records of the health and welfare of stray animals, with a focus on dogs. Utilizing modern technology like QR codes and facial recognition, i-Scan aims to ensure that every dog on campus receives appropriate care and treatment. With this system, it will be easier for the Animal Welfare Committee and veterinarians to maintain accurate records of each dog's medical history and welfare, ultimately improving their quality of life.

PROBLEM STATEMENT

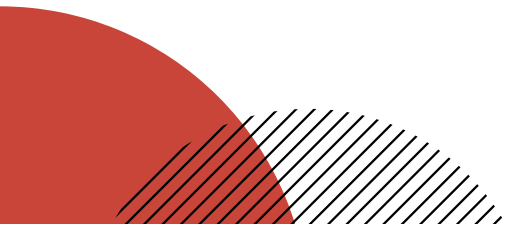
The problem addressed by the "i-Scan" project is the lack of an efficient and accurate method for managing the welfare of stray dogs, particularly on college campuses. Stray dogs can pose a safety risk to students, staff, and the dogs themselves due to a lack of proper care, food, and shelter. Current methods of dog identification and management, such as tagging and manual record-keeping, are often inadequate and prone to errors. As a result, there is a need for a more efficient and effective way of managing the welfare of stray dogs in urban areas. The "i-Scan" project aims to provide a solution to this problem.

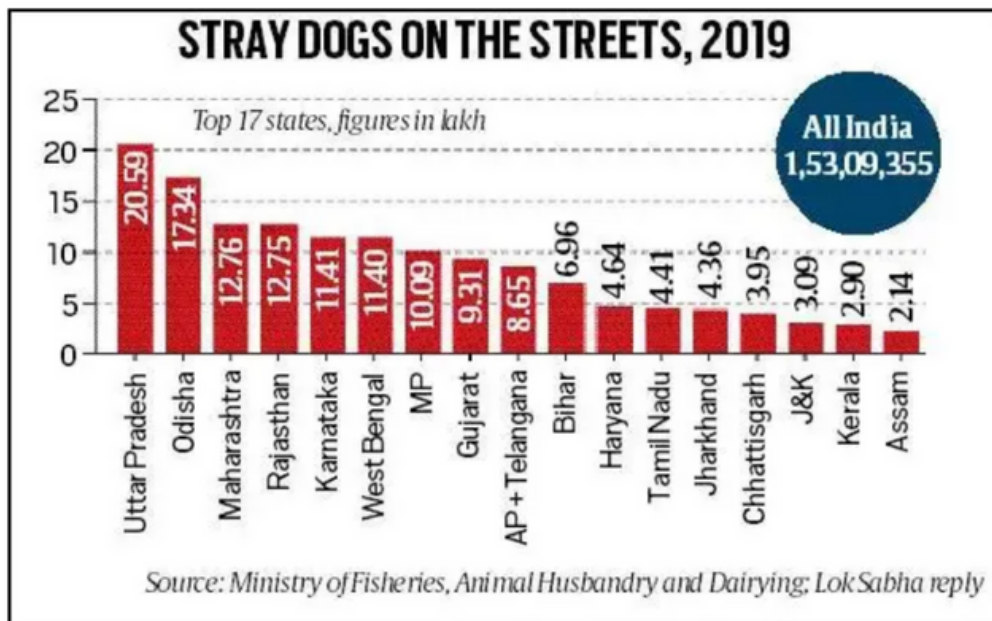
PROBLEM IDENTIFICATION

According to the latest report by the Animal Welfare Board of India, there are an estimated 80 million stray animals in India, including dogs, cats, cows, pigs, and others. The issue of stray animals in India is a significant concern, with many of these animals living in poor conditions and facing a range of health and welfare issues. Stray dogs, in particular, can pose a threat to public health, with cases of dog bites and attacks reported regularly.

The Indian government has implemented various programs to address the issue of stray animals, including sterilization and vaccination campaigns, animal birth control programs, and animal adoption programs. However, the success of these initiatives has been limited, with many challenges remaining, including funding and infrastructure constraints, a lack of public awareness and education, and a shortage of trained personnel.

The issue of stray animals in India is a complex and multifaceted problem that requires a comprehensive and sustainable approach. It is crucial to balance the welfare of animals with public safety and to work towards a solution that is both humane and effective.





Source: Ministry of Fisheries, Animal Husbandry and Dairying; Lok Sabha reply

Fig 1: Data of Stray dogs on the streets.

Population of pet dogs in india!

India has seen a significant increase in the population of pet dogs over the past decade. According to estimates, the population of pet dogs in India has increased from around 7 million in 2014 to over 20 million in 2023. This represents a threefold increase in just nine years.

The increasing popularity of pet dogs in India can be attributed to several factors, including rising disposable incomes, changing lifestyles, and growing awareness of the benefits of pet ownership. Many people now see dogs as loyal and loving companions that provide them with a sense of security and happiness.

The trend of pet ownership is particularly strong in urban areas, where people have more space and resources to keep dogs as pets. However, even in rural areas, there has been a growing interest in keeping dogs as companions, especially among younger generations.

While the increasing population of pet dogs in India is a positive trend, it also poses several challenges. Many pet owners lack the knowledge and resources to provide proper care for their dogs, which can lead to health and behavioral problems. Additionally, the lack of adequate pet-friendly spaces, such as parks and veterinary clinics, can make it difficult for pet owners to provide their dogs with the care they need.

The marking of sterilized and unsterilized dogs are currently done in these ways:

Ear tipping: While the dog is unconscious, the tip of one ear, generally approximately a quarter inch long, is removed. This method of marking sterilized canines is secure and obvious from a distance.

Tattooing: To show that a dog has been sterilized, a tiny tattoo can be applied on the interior of the ear. Although the dog must be put to sleep for the surgery, this mark is permanent and noticeable.

Microchipping: Information about the dog, such as whether it has been sterilized, may be stored on a microchip that is placed beneath the dog's skin. This technique of marking is permanent and impervious to tampering, but it needs to be read by a microchip scanner.

Collars or tags: Sterilized dogs might wear a particular collar or tag that serves as a reminder that they have been neutered or spayed. This approach is not infallible, though, as collars and tags may be removed with ease.

The origin of the problem addressed by the "i-Scan" project can be traced back to the issue of stray dogs in urban areas. Stray dogs are a common problem in many parts of the world, and they often suffer from a lack of proper care, food, and shelter. This can lead to health issues, aggressive behavior, and other problems, posing a risk to the safety of humans and animals alike.

In the case of college campuses, stray dogs can pose a safety risk to students, staff, and the dogs themselves. The lack of proper management of stray dogs can lead to incidents such as dog bites and attacks, which can have serious consequences. Moreover, it can also lead to a negative impact on the environment, including the spread of diseases and the destruction of property.

Furthermore, the safety and welfare of dogs is a growing concern among pet owners, animal welfare organizations, and governments worldwide. According to the American Society for the Prevention of Cruelty to Animals (ASPCA), approximately 3.3 million dogs enter animal shelters in the United States each year, and about 670,000 of them are euthanized. The ASPCA also reports that lost or stolen dogs are a common problem, with one in three pets becoming lost at some point in their lives.

Current methods of dog identification and management, such as tagging and manual record-keeping, are often inadequate and prone to errors. Tagging can be removed or damaged, and manual record-keeping is time-consuming and requires significant resources, making it impractical for the large-scale management of stray dogs. The origin of the problem, therefore, lies in the lack of an efficient and accurate method for managing the welfare of stray dogs,

DETAILED DESCRIPTION OF THE PROBLEM

Traditional paper-based record-keeping systems can be easily lost or damaged, even Excel sheet logs are hard to revisit, making it difficult to retrieve a animal's information when needed. This can lead to confusion, missed vaccinations, and difficulty locating lost or stolen animals. In addition, managing multiple animals with specific medical conditions can add to the challenge.

The consequences of poor record-keeping can be serious. A animal that is not up-to-date on its vaccinations is at risk for contracting and spreading diseases. A lost or stolen dog without proper identification can be difficult to locate, increasing the likelihood of the animal ending up in a shelter or being euthanized.

A animal with a medical condition that is not properly managed may suffer needlessly, and may require costly and time-consuming treatments that could have been avoided with proper record-keeping.

HOW DOES OUR PROJECT CONTRIBUTE TO RESOLVING PROBLEMS ?

Increased Safety: iScan and QR codes for dog identification will increase safety by making it simpler for owners to find their lost or stolen animals. Due to the identification's ability to serve as a deterrent to potential thieves, technology can also aid in the prevention of dog theft.

Improved Health Care: By connecting the identification system to the dog's medical records, vets will have better access to the dog's immunization records, medical history, and other vital health data. This will aid in ensuring that pets receive the right medical attention and care.

Better Record-Keeping: The identification system can also be used to maintain tabs on a dog's pedigree, genealogy, and other vital details that may be essential for pet shops and breeders.

Easier Adoption Process: A quicker and more accurate match between a dog and its owner or a possible adopter can be made if a dog is located as a stray and brought to a shelter using the identification system.

CURRENT DEVELOPMENTS IN THE DOMAIN

Recent years have seen considerable breakthroughs in the fields of animal welfare and pet care, particularly in the incorporation of technology. Numerous groups and businesses have made significant investments in the creation of cutting-edge approaches to animal care and security.

The use of wearables and Internet of Things (IoT) devices for tracking and monitoring animal behavior and health is another advancement in the field. These gadgets can monitor a number of variables, including heart rate, temperature, and activity levels, to gather information on the health of the animal. These gadgets' data can be analyzed to find any anomalies or health problems and notify owners or carers in real time.

Additionally, there has been a rise in interest in the creation of telemedicine programmes for the care of animals, particularly in the wake of the COVID-19 pandemic. There have also been a number of developments in the nutrition and pet food industries. Based on each pet's unique requirements and health problems, businesses have started creating specialized diets and nutritional regimens.

In conclusion, the use of technology has been advancing quickly in the fields of pet care and animal welfare, which has aided in enhancing the security, health, and well-being of animals. Some of the most recent advancements in the field include the usage of telemedicine solutions, facial recognition technology, wearables and Internet of Things (IoT) devices, customized diets, and nutrition regimens.

NEED AND SIGNIFICANCE OF RESOLVING THE PROBLEM

Ensuring the safety and welfare of animals is not only a moral obligation but also an economic and social necessity. Animals are often mistreated, lost, and stolen, resulting in financial and emotional distress for their owners and endangering public safety.

Adopting advanced technologies such as facial recognition, wearables, and telemedicine can help to establish accountability and traceability, prevent dog theft and abuse, and improve overall living standards for both humans and dogs. It is imperative to invest in solutions that can effectively track and monitor dog health, prevent mistreatment, and provide timely medical care.

GOALS PERTAINING TO REMOVING THE PROBLEM

The goals for resolving the safety and wellbeing of dogs are intricate and include a variety of identification, tracking, and medical difficulties. Some of the key goals of our project "i-Scan" include the following:

1. Identification

Our project's main objective is to offer a precise and effective method of canine identification. Facial recognition technology will be used to accomplish this, making it possible to quickly and precisely identify canines and their owners.

2. Tracking

Our project's other key objective is to offer animals a thorough tracking system. This will include particulars like the animal's birthdate, immunization history, and geographical limits. The tracking device will make it simple to keep track of the animal's whereabouts and movements, lowering the likelihood that it will go missing or get stolen.

3. Healthcare

An additional important objective of our project is to guarantee the health and welfare of animals. Our goal is to provide information on the animal's medical background, including specifics on whether it has undergone sterilization, the status of its immunisations, and any potential medical issues. In addition, we hope to offer telemedicine options that will enable remote animal health issues diagnosis and treatment.

4. Deterrence

By establishing a system of responsibility and traceability, our approach also seeks to discourage animal theft and abuse. We want to make it more challenging for thieves to sell or otherwise dispose of stolen pups by building a comprehensive database of animals and their owners.

5. Adoption

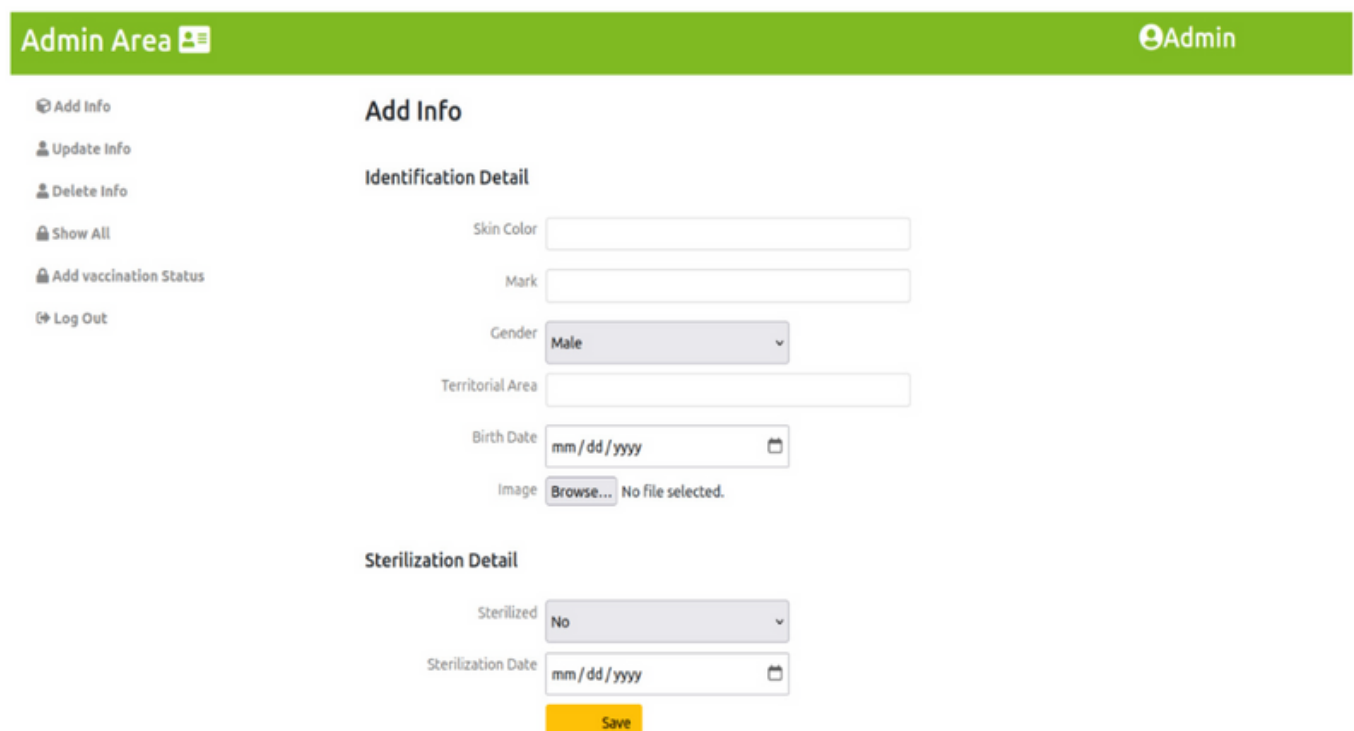
Finally, by giving prospective adopters thorough details about the animals up for adoption, our project hopes to raise adoption rates. This will enable more informed adoption decisions by providing details about the breed, temperament, and health history of the animal.

DETAILED WORKING PLAN AND TECHNOLOGICAL INTERVENTIONS

The detailed working plan and technological interventions for our project "i-Scan" are as follows:

1. Identification

To ensure ease of use and accessibility for animal owners, we plan to develop a user-friendly website. This website will allow owners to input detailed information about their animals, such as their medical history, vaccination status, and owner information. Users will have unique login credentials, allowing them to edit or delete their animal's data as needed.



The screenshot displays the 'Admin Area' interface with a green header bar containing 'Admin Area' and a user profile icon labeled 'Admin'. A sidebar on the left lists navigation options: 'Add Info', 'Update Info', 'Delete Info', 'Show All', 'Add vaccination Status', and 'Log Out'. The main content area is titled 'Add Info' and contains two sections: 'Identification Detail' and 'Sterilization Detail'. The 'Identification Detail' section includes input fields for 'Skin Color', 'Mark', 'Gender' (a dropdown menu currently showing 'Male'), 'Territorial Area', 'Birth Date' (a date picker showing 'mm/dd/yyyy'), and 'Image' (a 'Browse...' button with the text 'No file selected.'). The 'Sterilization Detail' section includes a 'Sterilized' dropdown menu (showing 'No') and a 'Sterilization Date' date picker (showing 'mm/dd/yyyy'). A yellow 'Save' button is positioned at the bottom of the form.

Fig.1: User Interface of the Admin:y

2. QR Tags

One of the most crucial parts of our project involves tagging QR codes onto animal collars. These QR codes will be scannable by anyone, directing them to the website mentioned above and allowing them to view all the animal's data.



Fig 2: Design of the QR tags:

**I-SCAN BY IIT
ROPAR**

Hi I'm
Oreo

Animal's Information

Species:	Dog
Gender:	Female
Color:	White and black
Approx. Age:	6 months
Nature:	Calm
Territory	Near Satluj Hostel
Identification mark:	Brown eyes
Type:	Stray

Medical Information

Sterilization Status	✓
Sterilization Date	24 March, 2023
Vaccination Status	✓
Types of Vaccine & Date	1. DHPP 21st Jan, 2023 2. Booster Doze 17th Feb, 2023 3. Anti Rabies Vaccine 16th March, 2023

Owner's Information

This dog is a stray animal of IIT Ropar's territory.

For Adoption or any other related issues
Contact Animal Welfare Committee of IIT Ropar

Rahul Nadda: +91 86288 18063
Priya Bhakar: +91 89468 51741
Ullas Shrivastav: +91 6200 284 682

Fig 3: The mobile interface of the application:

3. Facial Recognition Technology

We'll also incorporate facial recognition technology into our project so that animals can be quickly and precisely identified. Utilizing this technology, users will be able to direct itself to the website by just scanning the animal's face.



Fig. 4: Facial Recognition Technology

4. Database

We have compiled a comprehensive database of IIT Ropar's stray dogs. This database contains details on each dog's gender, age, vaccination and sterilization history, any medical issues, and their territory. This database will make it simple to track and monitor canines and will also give a way to be accountable and traceable.

Database of IIT Ropar Stray Dogs:

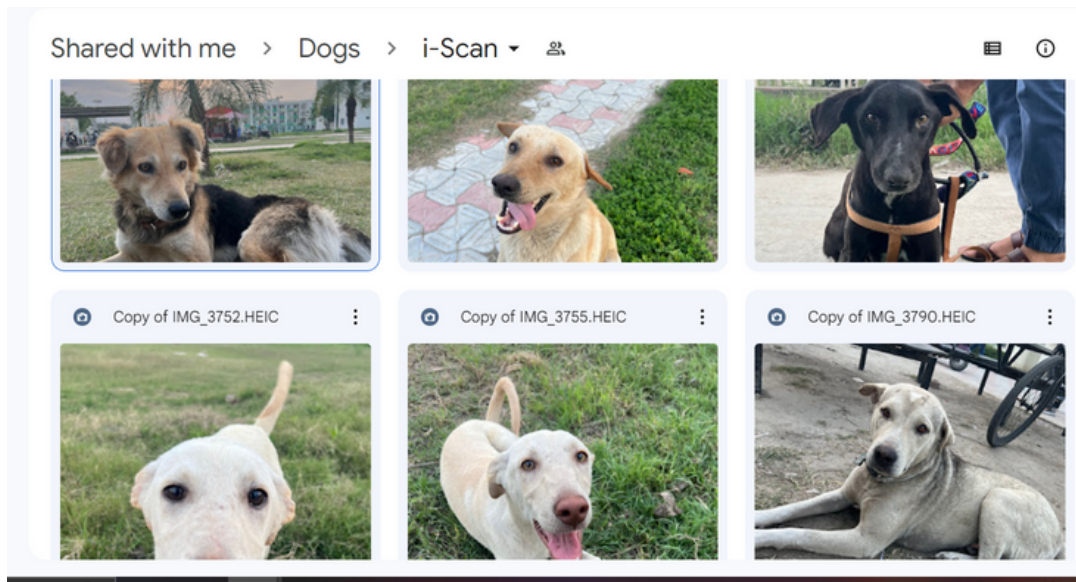


Fig. 5: Database of IIT Ropar Stray Dogs

5. Cloud-Based System

We will use a cloud-based system to store and manage the data collected by our project. This will allow for easy access to the information by authorized users, as well as ensuring the security and privacy of the data.

6. Artificial Intelligence

We will leverage artificial intelligence technologies to continuously improve the accuracy and efficiency of our facial recognition technology. This will involve the use of machine learning algorithms to analyze and learn from the data collected by our project.

In summary, our working plan and technological interventions involve the development of a user-friendly website, the integration of facial recognition technology, the creation of a comprehensive database, the provision of telemedicine solutions, the development of a mobile application, the use of a cloud-based system, and the implementation of artificial intelligence technologies. These interventions will enable us to provide a comprehensive solution to the problem of animal safety and welfare.



INNOVATION OF THE PROPOSED INTERVENTIONS

The proposed interventions of the i-Scan project are innovative and have the potential to revolutionize the animal welfare industry.

1. Facial recognition Technology

The i-Scan project uses facial recognition technology for identifying and tracking animals. This technology is relatively new and can provide numerous benefits over traditional identification methods.

2. Mobile Application

The i-Scan project is developed as a mobile application, which makes it easily accessible to animal owners and rescue organizations. The mobile application can be used on any smartphone with a camera and internet connection.

3. Real-time updates

The i-Scan project provides real-time updates on the animal's status, including vaccination status, sterilization status, territorial area, and identification marks. This can help animal owners and rescue organizations to track the animal's health and welfare.

4. Cloud-based database

The i-Scan project stores all data on a cloud-based database, making it accessible from anywhere in the world. This can be useful for rescue organizations that operate in multiple locations and need to access data from different locations.

Integration with veterinary clinics

The i-Scan project can be integrated with veterinary clinics, which can help to streamline the vaccination and sterilization process. The integration can also help to ensure that the animal's health records are up to date. The i-Scan project's adoption of facial recognition technology and mobile application presents various advantages for animal welfare. These include improved identification and tracking of animals, prompt updates on their well-being, and a streamlined vaccination and sterilization procedure.

APPROACHES THAT CAN BE TAKEN TO IMPLEMENT PLANS

To implement the plans for the i-Scan project, several approaches can be taken. These include:

1. Collaborating with rescue organizations

The i-Scan project can collaborate with rescue organizations to gain access to their database of animal's. This can help to increase the number of animals that are tracked by the i-Scan project.

2. Market and outreach

The i-Scan project can use social media and other marketing techniques to increase awareness of the project and encourage animal owners to use the mobile application. Outreach efforts can also be targeted at veterinary clinics, animal shelters, and other organizations that work with animals.

3. Developing partnerships with veterinary clinics

The i-Scan project can develop partnerships with veterinary clinics to integrate the project with their patient management systems. This can help to streamline the vaccination and sterilization process and ensure that the animal's health records are up to date.

4. Developing strategic alliances with technology companies

The i-Scan project can develop strategic alliances with technology companies that can provide expertise and support for the development of the project. These alliances can also help to increase the visibility of the i-Scan project and attract more users.

5. Developing a user-friendly interface

The i-Scan project can focus on developing a user-friendly interface that is easy to navigate and understand. This can encourage more animal owners to use the mobile application and increase the number of animals that are tracked by the project.

POSSIBLE CONSTRAINTS AND BARRIERS TO IMPLEMENTATION

Implementing the i-Scan project may face some potential constraints and barriers, including:

1. Funding

Developing and maintaining the i-Scan project will require significant funding. This could be a challenge if there is insufficient financial support or if the project does not receive enough grants or investments.

2. Data privacy and security concerns

The i-Scan project will be collecting sensitive data about animal and their owners, which could raise concerns about privacy and security. Ensuring the data is secure and complying with data protection laws and regulations will be critical to the project's success.

3. Technological limitations

The i-Scan project relies on face recognition technology to identify animals. If the technology is not accurate or reliable, it could limit the project's effectiveness.

4. User adoption

The success of the i-Scan project will depend on animal owners' willingness to use the mobile application. Encouraging adoption and ensuring that the application is user-friendly and easily accessible will be critical.

5. Limited availability of veterinary clinics

In areas where veterinary clinics are scarce, it may be challenging to ensure that animals are vaccinated and sterilized. This could limit the effectiveness of the i-Scan project in these areas.

6. Cultural barriers

In some cultures, sterilizing animals may not be a common practice. In such cases, educating the community and building trust may be necessary to promote the project.

7. Language barriers

The i-Scan project will be more effective if it can reach a wider audience. However, language barriers could limit its effectiveness in some areas. The project may need to be translated into multiple languages to overcome this barrier.

EXPERTISE AVAILABLE TO CONTRIBUTE IN DEVELOPMENT

1. Requirement of Technical Expertise

The development of the i-Scan project will require a range of expertise across multiple fields. The project will require individuals with technical expertise in web development, artificial intelligence, computer vision, and database management. It will also require individuals with expertise in veterinary medicine to ensure the accuracy of the data being collected and stored.

To begin with, a team of experienced web developers will be required to design and develop the i-Scan website. These individuals must deeply understand website development frameworks and be skilled in languages such as HTML, CSS, and JavaScript. They will also need to be proficient in programming languages such as Python and PHP, which will be required to implement the machine learning algorithms used for animal face recognition.

Alongside web developers, the project will also require individuals with expertise in artificial intelligence and computer vision. These individuals will be responsible for developing the algorithms that power the animal face recognition feature of the i-Scan website. They will need to have a deep understanding of machine learning algorithms and be skilled in programming languages such as Python and TensorFlow.

In addition, individuals with expertise in database management will be required to design and implement the database structure for the i-Scan website. These individuals must be proficient in database management systems such as MySQL and MongoDB and have experience with database design, development, and optimization.

2. Medical Expertise

Finally, the project will require individuals with veterinary medicine expertise to ensure the accuracy of the data being collected and stored. These individuals will be responsible for verifying the accuracy of the animal identification data, including breed, gender, sterilization status, vaccination status, and other health-related information. They will also be responsible for verifying the accuracy of the animal face recognition feature to ensure that the system is correctly identifying each animal.

EXPECTED OUTCOMES

The expected outcomes of the "i-Scan" project can be categorized into the following areas:

1. Improved Safety and Welfare of Animals

The main objective of the i-Scan initiative is to enhance the wellbeing and security of animals. By offering animal owners and welfare organizations convenient access to information regarding specific animals, including their vaccination and sterilization status, as well as territorial coverage, the i-Scan project can aid in preventing disease transmission, lowering the number of unwanted litters, and promoting responsible animal ownership.

2. Increased efficiency of Animal Welfare Organizations

The i-Scan project collaborated with the Animal welfare committee of IIT Ropar and got a very positive response/support from their side. Our project can also help to increase the efficiency of animal welfare organizations outside IIT Ropar by providing them with a centralized database of information about animals in their care. This can help them manage their resources better, track the progress of animals in their care, and make more informed decisions about allocating resources.

3. Enhanced Public Awareness of Animal Welfare Issues

The i-Scan project can help raise public awareness of animal welfare issues by giving animal owners and the general public easy access to information about responsible animal ownership, animal welfare laws and regulations, and other relevant topics. This can help promote a culture of responsible animal ownership and encourage more people to participate in animal welfare initiatives.

4. Improved Data Management and Analysis

The i-Scan project can enhance our comprehension of animal behavior, health, and welfare by gathering and examining data about individual animals. This can enable researchers and animal welfare experts to detect trends and patterns, devise novel approaches to enhance animal welfare, and make better-informed decisions about resource allocation.

Consequently, the expected results of the i-Scan initiative are substantial and have the ability to produce favorable effects on animals and their owners, as well as the wider animal welfare community.



SUGGESTED PLAN OF ACTION FOR UTILIZATION OF OUTCOME

1. Publicity and Marketing

The project should be advertised widely to reach out to potential users. This can be done through social media, flyers, and partnerships with local animal shelters. Additionally, partnerships with veterinary clinics and animal hospitals can be established to promote the project.

2. User Engagement

The project should be user-friendly to encourage its use. Feedback mechanisms should be implemented to allow users to report issues and provide suggestions for improvements.

3. Expansion

The project can be expanded to cover more areas, including additional features such as a lost-and-found database and pet-friendly locations.

4. Collaboration

Collaboration with government agencies, animal welfare organizations, and other stakeholders can be established to ensure that the project is fully utilized and sustained over time.

5. Data Analysis

Regular data analysis should be conducted to determine the impact of the project on animal welfare and to identify areas for improvement.

6. Continuous Improvement

Based on feedback and data analysis, the project should be continuously improved to ensure that it remains relevant and effective.

7. Financial Sustainability

A sustainable funding model should be established to ensure the project's long-term success. This can be achieved through partnerships with corporate sponsors, government agencies, and animal welfare organizations.

CONCLUSION

In summary, the i-Scan project is a promising initiative that aims to improve animal welfare by utilizing modern technology to maintain digitized records of animals' health and well-being. The project was inspired by the need to address the issue of sterilization and vaccination markings for stray dogs at IIT Ropar. By enabling the tracking of campus dogs and storing important information about their medical history and status, i-Scan has potential applications for pet owners, rescue centers, institutes with stray animals, and pet stores. The project team has employed various resources and methodologies, such as QR codes and facial recognition technology, to achieve their goals. The anticipated results of the i-Scan initiative include better animal welfare, reduced incidents of missing animals, and increased awareness of animal welfare issues within the community. Overall, the i-Scan project embodies a creative and innovative approach to animal welfare, and its success could have a significant impact on the lives of animals and their owners.

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