# Introduction

## Problem statement

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| “On a global scale, over 600 million dogs and the same number of cats are classified as strays” (malaysiakini, 2022). Overpopulation of stray animals has been an unceasing problem for many countries and cities. This issue threatens both the human community and other wildlife. Stray animals, in their harsh living conditions, are susceptible to infectious diseases like rabies, creating a zoonotic risk for both animals and humans. Their aggressive behavior increases the likelihood of injuries to people, and reports indicate a rise in traffic accidents caused by stray animals crossing roads. Aside from that, stray animals may prey on native species and compete for resources, resulting in the loss of biodiversity and disruption of ecosystems. Another significant aspect of this issue is the loss of pets and the challenge faced by owners in finding their missing companions. The difficulty in locating and reclaiming lost pets not only increases the burden on animal shelters and welfare organizations, but also contributes to the overall challenge of managing stray animal populations. |

## Main issue:

Overpopulation of stray animals.

## Effects:

-Spread of zoonotic risk/Public health concern: Rabies

-Safety issue: Bite people

-Decreased quality of living environment: Stray animals can jeopardize the cleanliness of the public environment and their feces can cause air and water pollution

## Causal relationship

A cartoon of a dog

Description automatically generated

**-Stray animals** are domesticated animals that were once owned but are now without a specific owner.

**-Feral animals** are wild or semi-wild animals that may be descendants of domesticated animals but have adapted to a wild environment.

-So, more abandoned/lost pet = more community animals = big issues

# Our Solution

## Main Method:

Creating an app that can help in reducing the source of stray animals (lost pet). Lost pet/ Abandoned pet = main source of stray population

## How We Implement

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| * **Create Lost Pet Post:** User (pet owner) can upload image of the lost pet, input details including the pet’s gender, specific description that helps identify the pet, pet’s last seen location and date, and his/her contact number. User (pet owner) can also upload a short voice message along with the post, which can be helpful for user who has found the pet to check the reaction of the pet to the owner’s voice. * **Create Found Pet Post:** User can upload image of the pet found, input details including the pet’s gender, found location, found date. * **View Lost Pet Post from others:** User that found the pet can directly PM the owner. User that seen the pet can mark the last seen location for the owner. * **View Found Pet Post from others:** User can view the found pet post from other users, if his/her lost pet is posted, he/she can PM the finder. * **Matching Results:** User can input description of the lost pet, and the system will crosscheck the repository and display all found pet entries with matching descriptions in their lost pet post. A screenshot of a phone    Description automatically generated * **Google Map (location):** The app integrates with Google Map API to display the user’s (pet owner) location and the locations of all nearby found pets with matching descriptions. This improves the efficiency of searching for lost pets as the one at the nearest location is more likely to be the pet owner’s lost pet. * **Charity:** User can perform online transactions to donate to any fundraising event for stray animals. Users can register and join charity events via the app. |

# Project Setup

## Please clearly describe the challenge you are solving using a problem statement.

“On a global scale, over 600 million dogs and the same number of cats are classified as strays” (malaysiakini, 2022). Overpopulation of stray animals has been an unceasing problem for many countries and cities. This issue threatens both the human community and other wildlife. Stray animals, in their harsh living conditions, are susceptible to infectious diseases like rabies, creating a zoonotic risk for both animals and humans. Their aggressive behavior increases the likelihood of injuries to people, and reports indicate a rise in traffic accidents caused by stray animals crossing roads. Aside from that, stray animals may prey on native species and compete for resources, resulting in the loss of biodiversity and disruption of ecosystems. Another significant aspect of this issue is the loss of pets and the challenge faced by owners in finding their missing companions. The difficulty in locating and reclaiming lost pets not only increases the burden on animal shelters and welfare organizations, but also contributes to the overall challenge of managing stray animal populations.

## What United Nations's Sustainable Development goal(s) AND target(s) did you choose for your solution? What inspired you to select these specific goals(s) AND target(s)?

**SDG 15**, focusing on Life on Land, emphasizes the need to protect and manage terrestrial ecosystems and biodiversity in a sustainable manner. This project aligns with two specific targets under SDG 15: **Target 15.5**, which seeks to protect biodiversity and natural habitats by preventing the extinction of threatened species and urgently halting biodiversity loss, and **Target 15.A**, which aims to increase financial resources for the conservation and sustainable use of ecosystems and biodiversity. The selection of SDG 15, and its specific targets, 15.5 and 15.A, for our solution was **inspired by** the **urgent global need to address the challenges posed by the overpopulation of stray animals.**

* Target 15.5 emphasizes the urgency of action to safeguard biodiversity and prevent the extinction of threatened species. Our solution addresses this target by tackling the issue of stray animal overpopulation, which can disrupt natural habitats and pose a threat to native species. Through our pet adoption initiative, the project actively contributes to protecting biodiversity by reducing the adverse impact of stray animals on ecosystems.
* Target 15. emphasizes the need to enhance financial resources to support conservation efforts for ecosystems and biodiversity. Our solution aligns with this target by promoting responsible pet ownership and encouraging donations to raise funds for animal welfare. By fostering pet adoption and financial contributions, the project supports the goal of increasing resources for the conservation and sustainable use of ecosystems, thereby advancing the broader objectives of SDG 15.

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| A green sign with white text and a tree and birds  Description automatically generated | * SDG 15 – Life on Land * “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.” |
| A green and white rectangle with animals and trees  Description automatically generated | * Target 15.5 – Protect Biodiversity and Natural Habitats * “Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.” |
| A green sign with white text  Description automatically generated | * Target 15.A – Increase Financial Resources to Conserve and Sustainably Use Ecosystem and Biodiversity * “Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems.” |

# Implementation

## Describe the architecture that your team chose for your solution. What are the high-level components of your architecture? What is the responsibility of each component?

* **Google Map API**: The Google Maps API is implemented for geographical mapping and location-based features. It enables the display of the user's location and the locations of all nearby found pets within our mobile app. Users may visualize and interact with the geographic information relevant to their pet adoption or lost pet search in real time.
* **Vision AI** (Google Cloud Vision API): Vision AI is implemented for sophisticated image analysis. Its responsibility is to extract relevant tags and information from lost or found animals.
* **Natural Language AI** (Google Cloud Natural Language API): Natural Language AI is utilized for processing textual descriptions in lost or found animal posts. It extracts meaningful tags and information from the text, providing additional context to the posts. This enhances the overall understanding of the animals' descriptions, making it easier for users to search for and identify potential matches.
* **Google Analytics**: Google Analytics provides insights into user behavior, engagement patterns, and the effectiveness of various app features. Metrics such as user retention, session duration, and popular app screens are monitored to refine and improve the user experience continually.

## Which specific products and platforms did you choose to implement these components and why?

* **Android Studio**: We utilize Android Studio as our primary platform for mobile app development. Its robust development environment allows us to create a user-friendly interface tailored for Android smartphones. Android Studio enables us to design, code, and test the app efficiently on emulators of various screen sizes and Android versions.
* **Firebase**: We chose to integrate Firebase into our architecture for data storage and real-time synchronization. It is capable of storing user accounts and pet posts, including textual content and images efficiently. Implementing Firebase Realtime Database ensures seamless communication between the mobile app and the backend, enabling real-time information retrieval and immediate updates. Firebase's scalability and real-time capabilities align with our goal of delivering a responsive and dynamic user experience.

# Feedback/Testing/Iteration

## Walk us through the steps you took to test your solution with real users (outside of your team).

An interactable prototype of our application is developed using Figma, providing a convenient way for users to experience and test its functionalities. The link to the Figma prototype is provided inside an online survey conducted through Google Forms, which is distributed to individuals including friends and pet owners who have or have not experienced losing their pets. The respondents are invited to explore our prototype, and share their thoughts or suggestions on our prototype, as well as their personal experiences of finding their lost pets.

## Provide three specific feedback points you received from real users.

Three specific feedback points:

* Pet Description
  + Feedback received: “While creating a lost pet post, I felt a bit unsure about what details to include.”
  + Some users found it challenging to create accurate and descriptive lost/found pet posts.
* Social Media Compatibility
  + Feedback received: “Make it compatible with Facebook and other social media. So, people can share posts in app to FB and other media, where others only need one click to get to the app and use it.”
  + Users wished for a feature to share found pets on their social media accounts directly from the app.
* Location Sharing
  + Feedback received: “When I spot a pet that matches a lost pet post, I wish there was an easier and quicker way to share the location.”
  + Users desire a more efficient method to share the location when they find a pet matching a lost pet post.

## What did you learn and how did it help improve your solution? What are three specific things you implemented and improved for your solution based on the feedback from users?

The user feedback provided valuable insights into areas where our solution could be enhanced. Below are three specific improvements based on the feedback:

* Guided Pet Description: From the feedback received, we noticed that users might face challenges entering clear descriptions, especially in emotionally distressing situations after losing a pet. To address this, we have implemented guided prompts and examples within both lost and found pet post creation process, to guide users in providing clearer and more detailed descriptions.
* Post Sharing on Social Medias: To address users' desire for more social features, we have introduced a new feature to share lost/found pet posts directly to popular social media platforms such as Facebook and Instagram. This enhancement expands the reach of posts, increasing the likelihood of successful reunions.
* Mark Last Seen Location: Initially, the lost pet post featured only a "PM Owner" button at the bottom, with the intention of enabling anyone who spotted a matching pet to contact the owner directly. The user feedback prompted a valuable idea to enhance the process by allowing users to quickly share their location with a single tap. Therefore, we introduced a new "Mark Last Seen Location" button on lost pet posts, allowing users who spot a pet matching a lost pet post to mark the location on the map directly, enhancing the overall lost-and-found process.

# Success and Completion of Solution

## How does your solution address the challenge you are looking to solve for? Describe the success of your solution using metrics, goals, and outcome.

The success of our solution can be measured through the following **metrics**:

* **Number of Successful Adoptions/Reunions**: As we are unable to determine the actual statistics of stray animals in the country, instead of measuring the reduction in stray animal population, we can monitor and measure the number of successful adoptions or reunion of lost pets with their owners through the use of our application.
* **Charity Event Fundraising Amounts**: The charity feature of our application enables users to contribute to fundraising events for stray animals. Tracking the participation rates, donation amounts, and the success of charity events provides insights into the community's engagement and the effectiveness of fundraising efforts.
* **User Engagement Metrics**: Monitoring user engagement metrics, such as the number of lost and found pet posts, messages exchanged between users, and app usage frequency, helps measuring the level of user satisfaction and our application’s overall impact

**Goal**: Reduce overpopulation of stray animals by aiming to increase adoption rates by 30% within the first year of app’s launch.

**Outcome:**

* Successful adoption of stray animals: E.g. Adoption rates have increased by 30% within the first year of our application’s launch.
* Successful reunion of lost pets: E.g. Our application has facilitated successful reunion of over 500 lost pets with their owners since the launch of our application.
* Amount of money raised through charity events: E.g. Charity events organized through the application have raised RM10000 in the past six months, which indicates strong community support.

Google technologies used to track usage analytics

To track usage analytics, we utilize Google Analytics for Firebase. This platform provides insights into user behavior, engagement patterns, and the effectiveness of various app features. Metrics such as user retention, session duration, and popular app screens are monitored to refine and improve the user experience continually.

## Demo Video (Prototype)

<https://youtu.be/U5C0fkNTvZU>

# Scalability/Next Step

## What do you see as the future / next steps for your projects? How would you expand your solution to reach a larger audience?

* **iOS Platform Expansion**: Since our application is only supported on Android devices, considering the prevalence of iOS devices in the smartphone market, we could expand the application to iOS devices to broaden the user base. We could also gather feedback from iOS users for refining and addressing any platform-specific concerns.
* **Geographical Expansion**: We could expand our solution by extending the application's coverage to include regions of other countries other than Malaysia to address the global issue of stray animal overpopulation.
* **Partnership and Collaboration**: Form partnerships with more animal welfare organizations, veterinary clinics, and local authorities to enhance the reach and impact of the application.

## Explain how the technical architecture of your solution could support (in its current state or with minor changes) scaling to a larger audience.

* **Cloud-Based Scalability**: The current architecture, utilizing Firebase for data storage and real-time synchronization, is inherently scalable. Firebase's cloud-based infrastructure provides the flexibility needed to effortlessly accommodate increasing user and data loads. This ensures that our application can scale with ease to meet the demands of a growing audience without compromising performance.
* **Vision AI and Natural Language AI**: Google Cloud Vision API and Natural Language API are scalable services that can handle increased processing demands as the user base grows. These APIs ensure the continued effectiveness of image analysis and textual information extraction functionalities.
* **Google Analytics**: As the user base expands, Google Analytics for Firebase will continue to provide valuable insights into user behavior and engagement. This data-driven approach supports ongoing improvements and optimizations to meet the evolving needs of a larger audience.

# Impact

## Does the entry establish a clear challenge using their problem statement? 🚀

The challenge we are addressing is the overpopulation of stray animals, a global issue impacting both communities and ecosystems. The problem statement emphasizes the threat posed by stray animals to human and wildlife, including the risk of infectious diseases, injuries to people, traffic accidents, and the loss of biodiversity. The difficulty in reclaiming lost pets further contributes to the challenge of managing stray animal populations.

## Do they explain clearly which (Selected SDG) they chose for their solution and why? 🚀

We selected SDG 15, "Life on Land," as our chosen UN Sustainable Development Goal. This aligns with the urgent need to protect terrestrial ecosystems and biodiversity. Specifically, we focused on Target 15.5, emphasizing the protection of biodiversity and natural habitats, and Target 15.A, calling for increased financial resources to conserve ecosystems and biodiversity. Our inspiration lies in contributing to the global effort to address the overpopulation of stray animals and its environmental and societal implications.

## Feedback from users, testing & iteration 🚀

1. Does the team clearly describe three feedback points they received from real users and the steps they took to test them?

The three specific feedback points received from real users addressed aspects related to pet description, social media compatibility, and location sharing. We have conducted testing through an interactive prototype on Figma distributed via Google Forms.

1. Is there evidence of what the team learned and how the solution was iterated upon based on user feedback?

Based on the feedback received from the users, we have implemented specific improvements, including guided pet descriptions, post sharing on social media, and the addition of a "Mark Last Seen Location" feature.

## Does the solution address the challenge (and problem statement) identified by the team? Does the team adequately describe the success of their solution using metrics, goals, and outcomes, or through cause and effect? 🚀

We have outlined key metrics, goals, and outcomes to measure the success of our solution in dealing with the problem statement related to the overpopulation of stray animals. The chosen metrics include the number of successful adoptions/reunions, charity event fundraising amounts, and user engagement metrics.

We have set a clear goal of reducing the overpopulation of stray animals by aiming to increase adoption rates by 30% within the first year of the app's launch. This goal is specific and measurable, providing a quantifiable target for success.

The outcomes we present, such as the successful adoption of stray animals, the reunion of lost pets, and the amount of money raised through charity events, serve as concrete examples of the solution's impact. These outcomes are directly linked to the metrics and provide a clear cause-and-effect relationship between the implementation of our solution and its success.

Furthermore, we employ Google Analytics for Firebase to track usage analytics, indicating our commitment to data-driven decision-making and continuous improvement. Monitoring metrics such as user retention, session duration, and popular app screens allows us to assess user behavior and refine the user experience over time.

## Is there evidence of next steps? Does the team display a clear plan for future extension to a larger audience if they were to continue?🚀

For future extension, our plan is to expand our application to iOS platform, extend coverage to other countries outside of Malaysia, and form partnerships and collaborate with more animal welfare organizations, veterinary clinics, and local authorities to enhance the reach and impact of our application.