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SAFAR:A Stray Animal Feeding AI Reward System

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Abstract: The current paper investigates how stray animals inurbanIndiafacechallengeseachdaytoobtainenoughfood. Rather than a lack of empathy from humans, the problem stems from a failure to create a systematic method for transforming empathy into practical actions. In response to this gap, the SAFAR (Stray Animal Feeding Artificial Intelligence Reward) application was created. SAFAR is a mobiletoolthatusesartificialintelligenceandgamificationto ensure that urban stray animals are fed.

In terms of implementation, the technology functions in thefollowingway:ausertakesapictureusingaReactNative application, which is then immediately processed by a YOLOv8computervisionmodelonaPythonFastAPIserver. If the AI model detects both an animal and food in the photograph, the user earns credits stored in their Firebase Firestore account. Cooldown intervals are embedded to reduce the risk of cheating. It was found experimentally that image analysis took less than two seconds and worked effectively in daylight conditions. Overall, theapplication does morethanfeedstrayanimals;itcreatesadatasetthatwillbe useful for local authorities and NGOs in mapping stray animals for vaccination programs

Keywords: Stray animal welfare; YOLOv8; object detection; gamification; React Native; FastAPI; Firebase Firestore;proof-of-work;urban AI; computervision

I. INTRODUCTION

Earlymorningobservationsofmedium-sizedIndiancities highlightanimportantyetnoticeableproblemwithrespectto stray animals. According to municipal authorities, there are millions of stray dogs in metropolitan cities like Delhi and Bengaluru,whichdoesnotincludethosestraycattleandstray cats. Although some citizens feed stray animals on their own out of concern, these practices are neither systematic nor consistent.Thisisevidencedbythefactthatwhileastreetmay have three persons feeding a group of stray dogs, the colony just nearby may remain unfed for several day

What makes the entire issue difficult to deal with is the absenceofformalrecognitionand feedbackprocessesforthe welfare programs conducted through the grassroots. Even though NGOs run campaigns on an occasional basis, daily feedingdependsentirelyontheactionsoftheindividualswho, without any formal support systems, often perform the task inconsistently.Ithasbeenproventhroughbehavioralscience thatpeopletendtocontinuetheirpracticesonlywhenthereis immediate feedback [1].

SAFAR(StrayAnimalFeedingAIReward)isanAI-based mobile application platform built on two main principles: verifying the feeding event and rewarding the person who feeds the animal. The verification of the feeding event is accomplishedbyusingaYOLOv8objectdetectorthatchecks ifthereisastrayanimalinthepictureandifthereisanykind offeedingactivity,suchasabowl,roti,orhandinthepicture. The reward will be given in the form of points, which can be redeemed by partners in the future.

II. RELATED WORK

A. AnimalWelfareTechnology

Most technology applied in the animal welfare space focuses on pet adoption platforms or emergency reporting apps for injured animals. None of this address the daily, routine challenge of structured stray feeding, and none include any verification layer. A user can claim a feeding event without any evidence, which makes digital reward schemes trivially exploitable. SAFAR is designed specifically around that gap.

B. ComputerVisioninAnimalMonitoring

Models for object detection, specifically those from the YOLO series, have found many uses in wildlife conservation and animal husbandry, such as estimating the number of endangered animals using aerial drones and analyzing the condition of cows in intelligent farms [2]. However, use cases in urban environments characterized by varying lighting conditions and viewpoints, as well as partial occlusions, have not garnered much focus. SAFAR fits this exact use case.

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C. GamificationforBehavioralChange

Sweatcoin and Forest apps have proven that small yet meaningful rewards in digital space can motivate people to adopt sustainable behavior in real life [3]. Despite proven resultsoftheimplementationofgamification in thesphereof health care and environment protection, as far as we know, gamification is yet to be used in the field of community animals' welfare.

D. ResearchGap

Currently,thereisnosystemthatprovidesanAI-enabled proof of work for the community-based feeding of strays. Withoutanysortofverifiableproof,rewardsystemswouldbe untrustworthy.SAFARsolvesthisproblemthroughtheuseof computer vision, not just to identify objects but actions too.

III. PROBLEM STATEMENT

Three main problems are interlinked here. Firstly, there isnoofficialrecognitionoftheroleofindividualfeeders, whichaffectsefficiencynegatively.Secondly,sincethereisno systemofverificationinplace,itpreventstheimplementation of any data-based program aimed at rewarding those people orimprovingtheirlives.Lastly,thepracticeoffeedingstrays doesnotcreateanydatabase,makingitimpossibleforNGOs and local authorities to vaccinate stray dogs.

The problem statement is framed such that efforts are made to build a system that will be able to identify instances of stray animal feeding based on images, assign credit scores to users, and prevent any form of duplication of incidents through considerations of the limitations of consumer-grade mobile applications and cloud systems...

IV. SYSTEM ARCHITECTURE

A. Overview

The SAFAR uses the decoupled three-tier architecture design. The Presentation layer uses the React Native mobile application used to authenticate users, take videos using the camera,andshowtheDashboard.TheApplicationlogiclayer consistsofthePythonFastAPIserverthatservestheYOLOv8 model and processes the Smart Validation algorithm. The Data layer uses Google Firebase Firestore that manages the real-time profiles and atomic point updates. All ML Inferences occur in the server-side through the REST APIs without burdening the user's mobile phone.

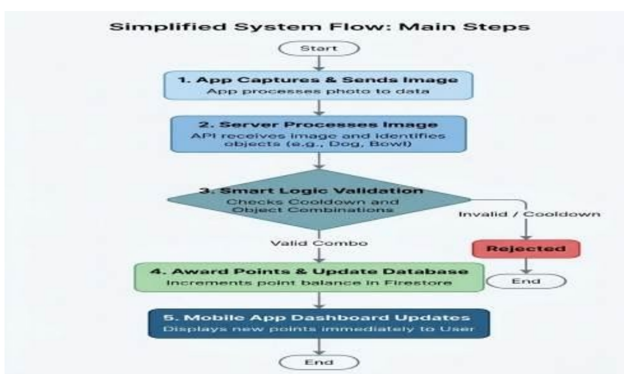

Fig.1.OperationalflowchartoftheSAFARfeeding verification and reward process.

B. MobileClient

React Native and Expo were used to build the front-end forAndroidandiOSfromthesamecodebase.TypeScriptwas extensivelyusedinthefront-endtominimizerun-timeerrors associated with asynchronous API requests and Firestore documents. On initiation of thefeeding session by a user, the front-end will lock itself until the POST request completes to prevent duplicate submissions.The front-end will update the points dashboard using an on-Snapshot listener immediately after the successful completion of the write operation on Firestore documents.

C. AI Backend

Thisbackendexposesoneendpointat/verify-feeding/that takes a multipart POST request containing image bytes and the UID of the user in Firebase. Uvicorn handles the server responsibilitiesofASGI,andtheFastAPIframework supports asynchronous functionality so that the endpoint can handle multiple requests without getting stuck. YOLOv8 parses the inputJPEGandoutputsa flatlistofthedetectedclasslabels, such as [‘dog’, ‘bowl’, ‘hand’].

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D. SmartValidationAlgorithm

Not only does the task involve object recognition but context-based understanding of the situation is required as well.Thecodeusestheabilityofthelabeltocorrelatebetween the two given arrays to determine whether or not to award points:valid_animals=["dog","cow","cat","animal"],and valid_food = ["hand", "roti", "biscuit", "bowl"]. If either animals or food are detected alone, then different responses will be returned for each case.

E. Anti-SpamandDataIntegrity

Before the score can be updated, the backend checks the Firestore database to see if the last_fed value has passed its time cooldown. If the user qualifies, the backend uses the FirestoreIncrement(10) operation to add 10 points to the score along with a SERVER_TIMESTAMP to prevent any race condition issues..

V. TOOLS AND TECHNOLOGIES

TableIsummarizesthecoretechnology stack.

Layer	Technology
Frontend	ReactNative,Expo,TypeScript
Backend	Python3.13,FastAPI,Uvicorn
AI/ML	UltralyticsYOLOv8
Database	GoogleCloudFirestore(NoSQL)
Auth	FirebaseAuthentication
Dev Hardware	NVIDIARTX4050(AcerPredator)

TABLEI.CoreTechnologyStack

VI. RESULTS AND DISCUSSION

A. TestCase1:SuccessfulVerification

This consisted of an image depicting a person feeding a biscuit to a stray dog. The YOLOv8 model successfully detected the “hand,” “dog,” and “biscuit,” and these specific detections were then verified by the Smart Validation algorithm. This enabled the user to earn 10 points within a span of 1.8 seconds.

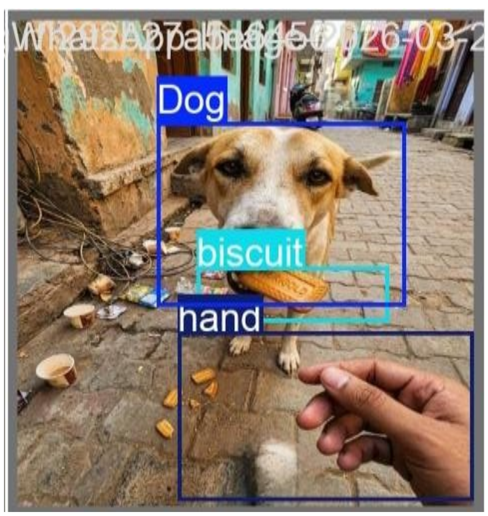

Fig. 2. Successful detection of 'dog', 'hand', and 'biscuit' classesbytheYOLOv8modelduringavalidfeeding session

B. TestCase2:MissingFoodIndicator

A picture showing one single cow with no indication of foodorbeveragewassentusingthemobileapplication.Inthis regard, while the YOLOv8 algorithm was able to detect the “cow” classification, the Smart Validation system identified that there were no valid_food objects.

Consequently, the responsesentbytheAPIwasnegative,anditautomatically prompted an alert pop-up window in the mobile application. Thisisproofthatthefront-endapplicationisabletointerpret the back-end process and implement the contextual feeding requirements.

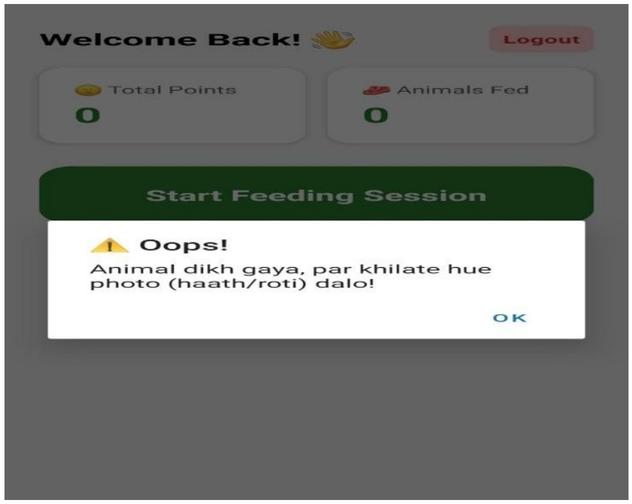

Fig. 3. Mobile application interface displaying a contextualvalidationalertwhenfoodobjectsaremissing fromthecaptured image.

C. TestCase3:SpamPrevention

Both images were valid and submitted by the same user one after another. However, the second image was submitted during the time period when the cooldown timer was still active, which resulted in the rejection of the second image at the timestamp check step before the YOLO model inference process.

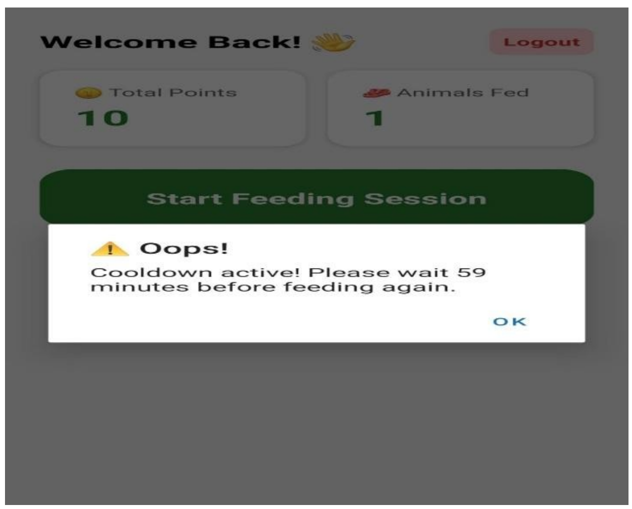

Fig. 4. Anti-spam mechanism triggering a 60-minute cooldownalertontheuserdashboardtopreventduplicateor rapid submissions

D. OverallPerformance

From around40 trialsconducted in differentlightsettings, the end-to-end latency was observed to stay below 2 seconds when tested locally on a network that had the RTX 4050 server. This was consistent when conducted in favorable day light.Indarkerindoorsettings,theaccuracybecamepoorer; details follow below.

VII. CURRENT LIMITATIONS

There are three major limitations associated with this buildofthealgorithm.Firstly,lowlightconditions:The accuracy of YOLOv8 goes down during the night, thus makingthenighttimescenariosvirtuallynon-existentinterms of implementation of an incentive system. This can be solved via pre-processing of the video (histogram equalization and CLAHE),aswellasviacreatingaspecialtrainingdatasetfor use during low light conditions. Secondly, reliance on a dedicated GPU:

The back-end needs a dedicated GPU in ordertohavesub-secondlatency;cloudcomputingwithouta GPU will significantly increase latency, making the instant- reward system inefficient

VIII. FUTURE SCOPE

Future advancements will bring more benefits to the system. For instance, the application of geospatial heat maps basedonGPS coordinatesattached to eachverifiedfeed post will help track the total number of strays in the city. Using leaderboards might make the application social in nature, which can be supported by the empirical evidence showing thatusingleaderboardsensurescontinuedparticipationfrom users over a long time period. Partnering with other companies and NGOs that provide incentives likediscounted pet food based on users' performance can be another area of interest for future studies.

IX. CONCLUSION

In the SAFAR model, there is a difference between the well-meaning behavior of people and their sustained and contributinginvolvementwithsocialgood.This,however,can be addressed through the deployment of a feedback-loop system. Using computer vision to verify and gamification as motivation makes it easier for people to engage in occasional acts of social good and make themselves more visible in the process. The scope of the project suggests another important ideathatisconveyedinit,whichisthattherearemultipleuses of artificial intelligence other than those that may seem obvious at first glance.

X. ACKNOWLEDGMENT

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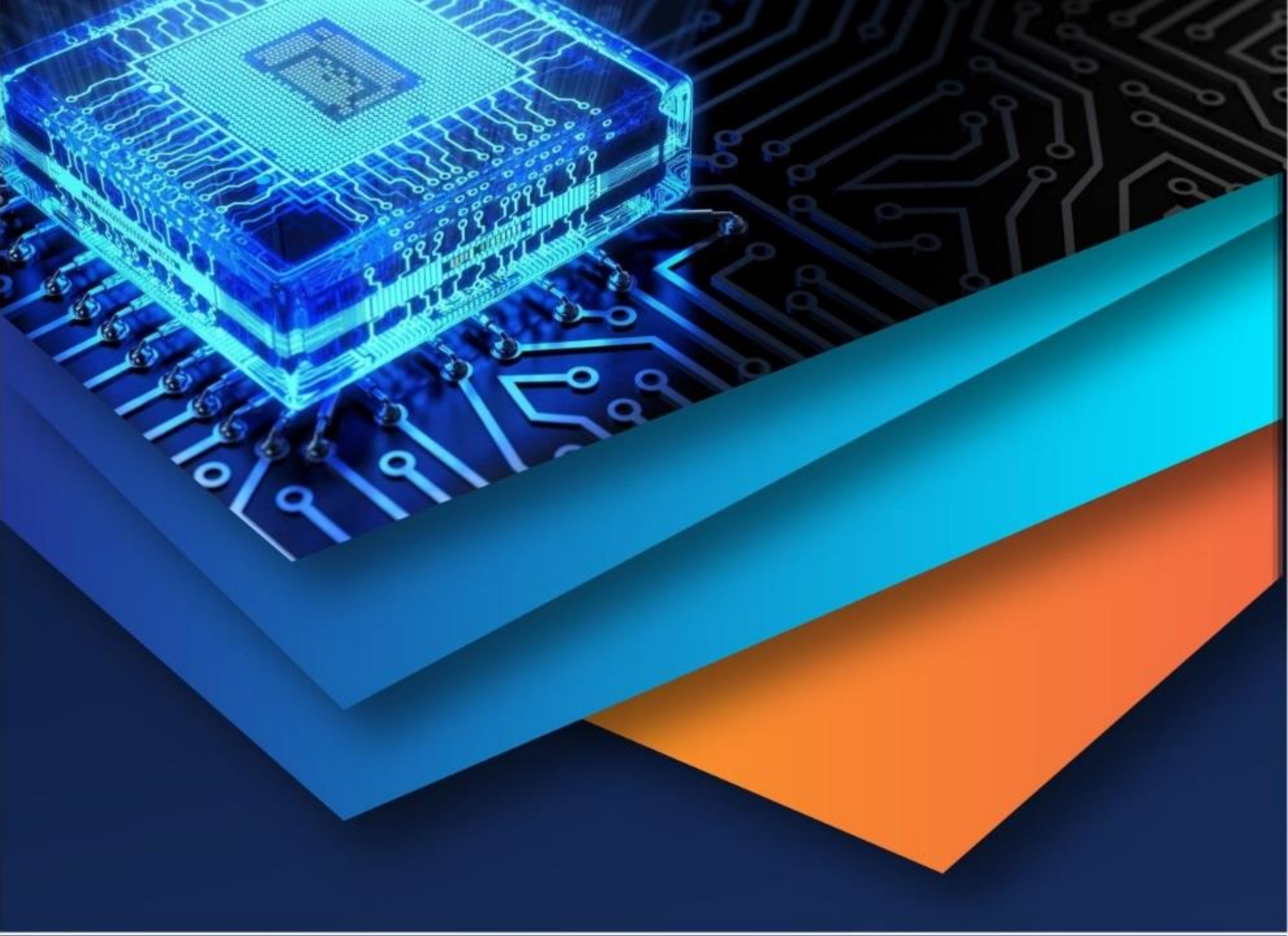

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