



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 3, March 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Artificial Intelligence Based Animal Care and Management System Using IoT

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ABSTRACT: This system not only contributes to rabies prevention, but also provides quality living to stray dogs according to basic requirements. The proposed system can be extended with an automatic animal feeder dispenser that allows volunteers to set a specific timing to fill the feed. In addition, the number of stray dogs is monitored and managed. This proposed architecture can be used in many ways. In a wildlife sanctuary, facilities are generally divided into sections. This proposed system is useful for forest guards because they can have a server that monitors the time of forest protection used during patrol activities. You can also monitor animal behavior and determine the number of specific animal species. In the event of an emergency, such as a forest fire, or if an animal is injured, you can send assistance on time.

I.INTRODUCTION

Stray animals are usually pets, but sometimes separated from human caregivers by fleeing, caring, or natural disasters. These animals usually include dogs, cats, cows, etc. In India, the number of stray animals has increased significantly over the years. According to statistics from the World Health Organization (WHO) in 2018, there are approximately 35 million stray dogs in India.

The population of street dogs in India is closely linked to city sanitation practices or even their neglect. The growing population of cats and cattle, as well as stray dogs, is subject to public health concerns. Dog bite, rabies, leptospirosis, cat scratching, etc. can occur. Disturbances caused by bar dogs in the street are also problems faced by residents of such areas. It is important to reduce stray animal populations, control the spread of disease transmission, and stop dog bites and attacks. Unfortunately, due to fear and ignorance, many Indian citizens and officials are merely annoying stray dogs and are seeking eradication using inhumane methods such as poisoning and assault. This has led to many cases of animal abuse in India. According to an article published in the South China Morning Post, the maximum penalty in the State of the United States for animal abuse in 1960 is US \$ 70 or up to three months in prison. Or sometimes both.

Smart Farming relays on basic needs of farmers, such as helping farmers to make farming. Instead of Farmer visiting the cattle or Poultry farms again and again for observing their health condition, we are using a computing and sensor based methods controlled by arduino module. To Achieve this, we have installed our system in the Poultry farms and cattle sheds through sensors. The measured data is stored at the consumers database , the consumer is allowed to extract this data through an android application installed in his/her mobile. It includes another feature of alarming i.e., if temperature of poultry farm exceeds or increases, sensor senses the temperature and arduino compares it with the prescribed safe range and if not in range signals an alarm, further the cloud pushes it to the consumers mobile app and notifies.

This is the ability to breed rapidly. A stray Dog has almost two litters of six to nine, and a kitten has up to three or nine kittens each year. Thus, in one lifetime, a set of stray cats can produce more than 80 to 90 kittens or more than 100 kittens, that is, hundreds of offspring for generations. The Government of India has taken action for neutering stray dogs and cats and have organized special drives for the same, but there are still few places left that will lead to an increase in the stray population.



II.LITERATURE SURVEY

The situation of Indian stray animals is unique. These animals here especially stray dogs, have evolved into their own class, surviving (and actually prospering) in Indian cities, fighting all the difficulties, and living with the love and support of India's tolerant human population. Hurting or killing stray dogs in India has almost always been criticized by public opinion. In the past, large numbers of dogs were killed to control dog populations. It is a proven fact that this does not work. The number of dogs quickly returns to their original size. This is defined by the availability of food (garbage). The motivation to control dog population through sterilization is primarily a human welfare project to protect people from dog bites and rabies. Here castration, (referred to as animal contraception or ABC program) and anti-rabies (AR) vaccination of dogs are considered humane methods of controlling the growing stray dog population.

The Animal Contraceptive (Dog) Regulations (2001) under the 1960 Animal Abuse Prevention Act revealed that Indian dogs must not be killed or moved to reduce their population. The cruel cases for these dogs occur at the national level, but nationals generally learn to live with these dogs, and many feed and care for these dogs on the street. Government and nongovernmental organizations work together in India to fund and implement the ABC-AR program. Positive results have been obtained in some states, and such activity has reduced the number of bites associated with dogs and has reduced the number of dogs to some extent. Hence there is a need of monitoring system where the government can have a record and check on the number of stray dogs in an area. This can help them to prevent rabies by controlling the reproduction rate.

Inspiring from various architectures, the main motive is to locate, monitor and track these stray animals. Back in 1900's methods like Radars, Isotope Analysis etc. were used to track different species and organisms. It took the onset of late 1970's where photo verifications were used to trace an animal. As evolutions took place technologies moved further to IOT Applications introducing the advent of Arduino Boards. Arduino is a microcontroller on which various input output devices such as sensors are attached to it.

In [7] the author has proposed a system to locate pet animals in small cities. As we know, pet animal monitoring in smart cities is a challenging problem. Few of the classic approaches to identify the animal and surveillance techniques include air tags, GPS, and RFID. It proves to fail providing the full required level of monitoring and tracking of the pets. These devices have many limitations and costly. This paper has approach of pet animal tracking on the video stream using deep learning capabilities with the goal to detect and classify the object of interest. But as the number of animals will increase this system will fail in terms of expenses and it will get difficult to monitor outdoor stray animals.

In [1] the author focuses on smart farming methodology considering basic needs of farmers, like helping farmers to automate farming. In the proposed approach, the authors have introduced an open and cost-effective concept used to create a smart farm animal welfare monitoring system. The position of the animals is collected for analysis purpose. Various sensors are used for sensing the Animal behavior, humidity, temperature and disease detection of animal like cattle, poultry farms, stables. The system is based on Arduino to monitor farm environment and animal. The information captured in sensors is saved in a database. Further a web-based database integrated application is created to make it user friendly. This data can be efficiently used to develop a sensing system that can effectively monitor multiple parameters related to animal welfare

In [2] the authors put light on improvising the Zoo conditions. A zoo is a local facility where some wild or exotic animals are placed in a fence. Its basic tasks include accommodation, breeding, health care, medical care for animals and tourist/ public management in the zoo premises. As there are around hundreds, thousands, or even ten thousand animals with different body shape, type and characteristics in the zoo that are to be cared for and managed. For this the animal administrators are needed to be skilled with using various tools to have a real time surveillance on the condition of all animals in each cage. This leads to resulting in the heavy workload and also requirement for the animal administrators and also a huge amount is involved for operating expenses of the zoo. Therefore, it is necessary to find ways to reduce the workload of the animal administrators, but also to immediately control the current state of the animals, while saving animal care and management expenses. This research paper proposes a development architecture for the intelligent animal management system based on the Internet of Things (IoT) and artificial intelligence (AI).

In[4] the author proposes a surveillance system to identify and monitor animals through trap images using deep learning. The main motive is to have accurate, detailed, and up-to-date information about wildlife with its location and behavior across huge geographic extends to aid revolutionizing the ability to study, conserve, and manage species and their respective ecosystems links. Looking over the ability to automatically, accurately, and inexpensively collect wild animal data could transform many fields of biology, ecology,



and zoology into “big data” sciences. For this, Motion sensor cameras called “camera traps” (Serengeti camera trap) enable pictures of wildlife to be collected inexpensively, unobtrusively, and at high volume. This camera traps were placed covering various locations, usually mounted on the trees. These cameras took real time images without disturbing the activities/movements of the animals. Also identifying these animals, animal attributes, and behaviors in these pictures is expensive, time-consuming, manually performed by researchers. In this paper the author demonstrates that such data can be automatically extracted by deep neural networks. For this supervised learning techniques were used where an existing human-labelled images from the Snapshot Serengeti dataset was taken to train deep convolutional neural networks. This includes identified 48 species in 3.2 million images taken from Tanzania’s Serengeti National Park. In this project the author succeeded training neural networks that automatically identify animals with over 92% accuracy expect to improve the number rapidly in years to come.

III.METHODS

The system mainly focuses on stray animal surveillance for a particular area. A local area is divided into several sub areas where the devices have been placed. Following are the four layers of the proposed architecture with their roles in the same.

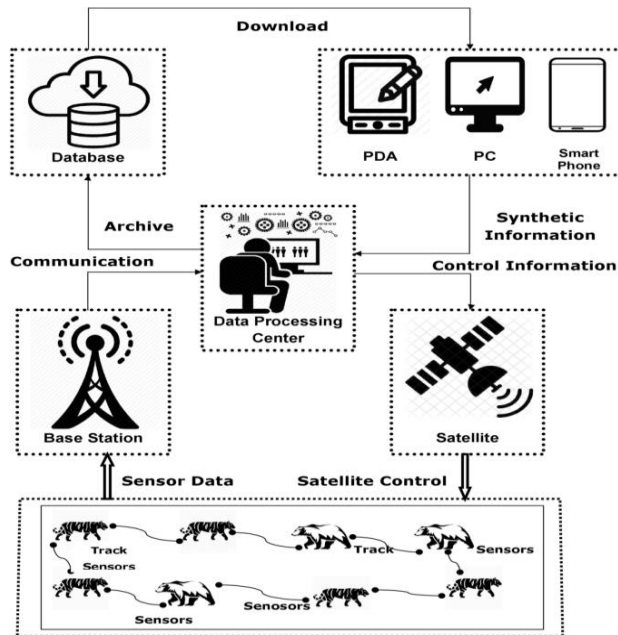


Fig 1: Block diagram

Convolutional neural networks (CNNs) are a type of artificial neural network used in image recognition and processing specially designed to process pixel data. CNN uses a system much like a multilayer perceptron designed to reduce processing requirements. The layers of the CNN consist of an input layer, an output layer, and hidden layers including multiple convolutional, pooling, fully connected, and normalization layers. Removing the limitations of image processing and increasing efficiency will result in a system that is much more effective and simpler than training with limited image processing and natural language processing.

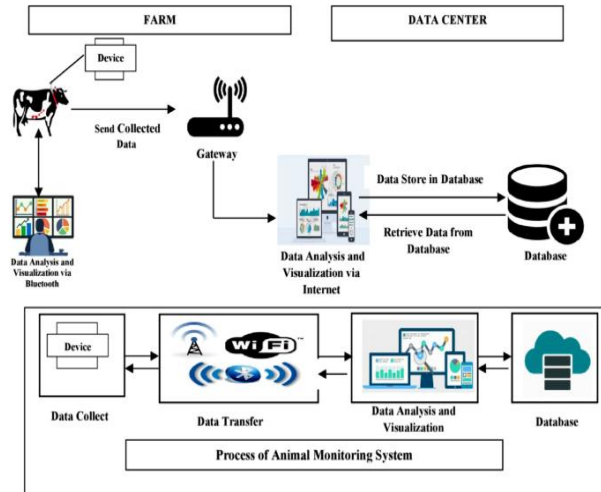


Fig 2: Animal care

In the proposed architecture we shall be using VGG16. VGG16 is a convolutional neural network model found by K. Simonyan and A. Zisserman of Oxford University in his dissertation "Very Deep Convolutional Network for LargeScale Image Recognition". This model achieves the top 5 test accuracy of 92.7% on ImageNet. This is a dataset of over 14 million images belonging to 1000 classes. One of the famous models submitted to ILSVRC-2014. It improved Alex Net by replacing large kernel size filters (i.e.11 in first and 5 in second convolutional layers) with multiple 3x3 kernel size filters one after the other. The VGG16 was trained for several weeks and used an NVIDIA Titan Black GPU.

IV.RESULTS

The first step is to collect data which is the most difficult aspect of any project. For the proposed architecture the data must be labeled. Kaggle has labeled images that can be easily downloaded. The working set are 16496 images belonging to 6 classes (i.e. animals). In case data set is unlabeled, it will be time consuming because one must manually create new labels for each category in the image. Another way is to just create a new label and move 100 photos to the appropriate label. Then, create such a classifier and classify the image with the machine. This causes errors in the classification, so it is recommended that you check it manually each time you run it. In this case, it takes time.

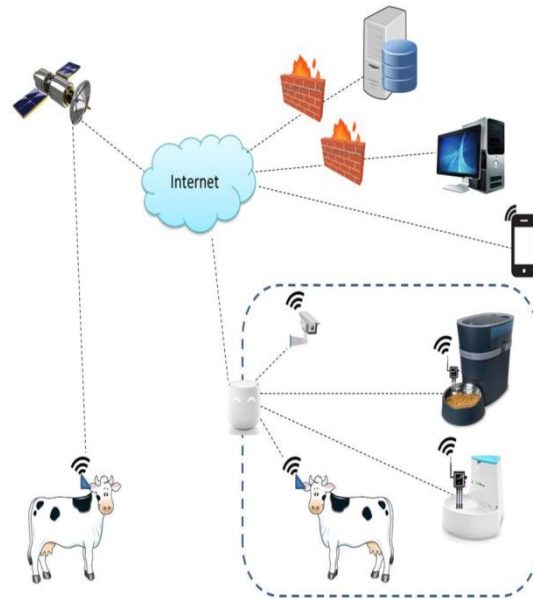


Fig 3: Animal Track

The training dataset contains 85-90% of the total labeled data. This data is used to train the machine on different types of images. The validation dataset contains 5-10% of the total labeled data. This tests machine performance against known labeled data. The test dataset contains the rest of the data in an unlabeled format. This test data is used to test how well a machine can classify data it has never seen before. In addition, test data can include downloaded Google images as long as the topic you are categorizing makes sense.

V.CONCLUSION

Currently Smart farming addresses basic needs of farmers , such as helping farmers to automate farming. In the proposed approach an open and low cost concepts used for smart fog(edge) system to create smart farm animal welfare monitoring. The position of the animals are collected for analysis purpose. Different sensors are used for sensing the temperature, humidity, animal behavior and disease detection of animal like cattles, poultry farms, stables. Our system will use Arduino as edge devices to monitor farm environment and animal. we emulate the cloud with a web-based database and will save sensors data that enables communication between mobile application and work station. We developed an low-cost and open computing and sensing system can effectively monitor multiple parameters related to animal welfare.

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