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AN ANALYSIS THE USE OFIOT AND ARTIFICIAL INTELLIGENCE TO AUTOMATE ANIMAL TRACKING SYSTEM

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Abstract:
AI deep learning technology, cloud database, IoT technology, and distributed computing will be utilized to support animal managers to obviously comprehend the individual species, physiological status, diet, and disposition, feed trough stock piling, water volume and other data. The work cost of the zoo and animal farm is decreased, the proficiency of the animal supervisor is improved, and the personal satisfaction ofthe animals in the zoo and farm is improved and ensured. So as to decrease costs andencourage execution, the proposed intelligent animal care and management systemarchitecture will be incorporated into the Raspberry Pi, AI, beacon, Wi-Fi, neighborhood Arduino and different communication innovations, for example, clouddatabase and distributed computing.Using these advances, some bulky methods forcaring animals are mechanized through the IoT and AI to push animaladministrators to systematically care for and oversee animals, for example, sensingthe internal heat level, mindset, action, and movement status of animals, generalcondition and position.
Keywords- IoT, Animal, Raspberry Pi, AI, Arduino, Zoo, Animal Tracking System

1. INTRODUCTION

IoT devices generate a lot of data, which needs to be gathered & investigated for meaningful outcomes. Here is where AI enters the picture. IoT acquires and organises the massive amounts of data required for AI systems. Thus, these algorithms transform the data into beneficial meaningful outcomes that the IoT devices may use. The words of Maciej Kranz, Cisco's vice president of corporate strategic innovation, are the ideal ones to add to this. "Without AI-controlled examination, IoT devices and the data they produce all through the network would have restricted worth. So also, AI systems would battle to be significant in business settings without the IoT-created data pouring in. Be that as it may, the ground-breaking blend of AI and IoT can change enterprises and assist them with settling on increasingly intelligent choices from the touchy development of data consistently. IoT resembles the body, and AI the cerebrums, which together can make new incentives, plans of action, income streams and services."

The zoo is home to a variety of exotic and interesting species. The core goals of the organization are education, animal welfare, and public enjoyment & exploration. Ninety-three percent agreed that their families enjoy visiting zoos and aquariums; ninety-four percent agreed that zoos or aquariums teach youngsters how animals & territories they rely on; eighty-nine percent of organizations that help zoo and aquarium natural life preservation feel good; sixty-six percent of respondents are obligated to purchase products or services from these organizations.

However, prior to enjoying these zoos' benefits, we should consider the animal care & management that goes into them. Depending on the size of the zoo, the number of animals that need to be cared for and supervised could easily reach the thousands. Since these animals come in a wide variety of sizes, shapes, and other characteristics, animal managers have a lot of work left to do and the zoo has to spend a lot of money on equipment. In light of this, coordinating modern data and communication technology will aid in resolving the issue. Data technology devices reliant on IoT technology are now available for the care of cats and dogs living in close proximity to humans. Based on the findings of this study, a new framework for improving IoT and AI-powered intelligent animal management systems is proposed. The primary goal is to help animal directors provide better care for their charges and keep better track of them by automating some tedious animal-care procedures using the IoT & AI.

2. OBJECTIVE

1. To automate some tedious procedures for caring animals through the AI & IoT
2. To support animal administrators to take care of them and manage them more systematically.
3. To minimize the energy consumption,
4. Efficient animal tracking system.
5. To identify, predict and prevent the zoonotic diseases like flu, SARS, Coronavirus etc.
6. and relative real time visualization.

3. PROPOSED METHODOLOGY

Research methodology is defined as the steps taken in order to systematically gather, organise, synthesise, analyse, & interpret data in order to gain a deeper understanding of the phenomenon or item being studied. AI deep learning technology, cloud database, IoT technology, and distributed computing will be utilized to support animal managers to obviously comprehend the individual species, physiological status, diet, and disposition, feed trough stockpiling, water volume and other data. The work cost of the zoo and animal farm is decreased, the proficiency of the animal supervisor is improved, and the personal satisfaction of the animals in the zoo and farm is improved and ensured. So as to decrease costs and encourage execution, the proposed intelligent animal care and management system architecture will be incorporated into the Raspberry Pi, AI, beacon, Wi-Fi, neighborhood Arduino and different communication innovations, for example, cloud database and distributed computing. With the help of the IoT & AI, administrators of animal facilities can more easily sense their charges' internal temperatures, mental or behavioural states, actions, and overall stateposition. Here, the everyday biomedical sensing data and ongoing pictures of the animals are sent to the cloud database of AI whenever and anyplace to frame a standard of animal wellbeing and conduct, and the animal movement status and biomedical sensing data are examined promptly through AI. In case of a variation from the norm in the animal, the animal directors are told and alarmed.

- Everyday biomedical sensing data and ongoing pictures of the animals are sent to the cloud database of AI.
- To frame a standard of animal wellbeing and conduct, and the animal movement status and
- Biomedical sensing data are examined promptly through AI.
- In case of a variation from the norm in the animal, the animal directors are told and alarmed.
- Qualitative and Quantitative Data Collection
- Stratified Sampling – count from categories of animals goats, dogs, cows etc.
- Location: Animal Farm/Zoo

4. METHODS FOR IMPLEMENTATION OF THIS ARCHITECTURE

This design can be actualized utilizing the accompanying related innovations:

A. Beacon

Guide is an innovation that utilizations low energy Bluetooth 4.0, which is a little and modest physical gadget. We can orchestrate it in different fields in the zoo to send data to cell phones or hardware inside a specific separation to accomplish message transmission to neighboring creatures. Use guide to peruse the data from the gear on the creature to accomplish the administration of creature action status and wellbeing observing, and furthermore to accomplish miniature situating, to dodge creature misfortune and to rapidly discover creatures.

B. Local region network usage

We can organize the organization in a particular region of the zoo to give a web association of the creature detecting gadget, and communicate the detected creature physiological sign and position to the cloud information base for capacity to accomplish enormous information and AI investigation. Thinking about the accommodation of remote organizations, Wi-Fi is a remote neighborhood that permits Wi-Fi empowered gadgets to interface network from a scope of remote organizations to at least one interconnected passage ways. The neighborhood is utilized to send the physiological signals and positions estimated by the hardware on the creature to accomplish the resulting examination of the creature action status and wellbeing observing administration, and furthermore to break down the creature movement go and comprehend the creature life propensities.

C. Arduino and Raspberry Pi

Arduino is a minimal effort, basic gadget actuator for building advanced gadgets and intelligent articles that connect with the climate to detect and control objects in the physical and computerized world. Raspberry Pi is a minimal effort, simple to-get, simple to convey, easy to introduce, stable activity, and can be associated with other fringe gadgets. It is a Linux-based single-chip PC that can get to the web and play out some confounded number-crunching

handling and examination. In 2018, NASA dispatched the open source Open Source Rover venture (a decreased variant of the Mars Rover Curiosity), utilizing the Raspberry Pi as a control module. The engineering proposed by this examination is to utilize Arduino as the transmission, access control and cloud administration related enormous scope disseminated cloud association heterogeneous organization sending of detecting information sequential port, and use Raspberry Pi as a microcomputer for ongoing observing and activity investigation to accomplish the creature's insightful administration work.

D. Artificial Intelligence (AI)

Subsequent to accepting the tangible information of creatures and the climate, the design proposed by this examination plans to assist us with investigating the conduct and condition of creatures through AI, so we utilize profound learning to manufacture the frail computerized reasoning for a unique creature permits us to comprehend the condition of creatures unmistakably. The design contemplations proposed in this examination utilize the profound learning engineering to recognize the creature's picture movement and the creature's voice feelings to comprehend the present status of the creature. The essential structure of the neural organization is appeared in Fig. 2. Each layer has a great deal of neurons. The yield of the upper layer is the contribution of the following layer. The quantity of concealed layers is the profundity of the neural organization. Get a lot of conclusive yield.

E. Cloud information base and distributed computing

So as to permit creature heads to advantageously utilize various stages or gadgets to store and utilize information, and furthermore permit AI to utilize incorporated information for gigantic information investigation and profound learning, the engineering created in this examination principally considers the utilization of cloud information and distributed computing development savvy creature care and the executives' framework. The advantages of utilizing the cloud stage are:

1. The zoo can deftly tweak the application and change the administration to suit their necessities, and access the cloud administration from anyplace through the web association.
2. Zoos can accelerate application improvement without agonizing over foundation expenses or upkeep.
3. Developers of the canny creature care and the executives' framework can zero in on application advancement and consistently update systematic techniques to give the most exact creature care and the board capacities for the zoo.

Animal section:

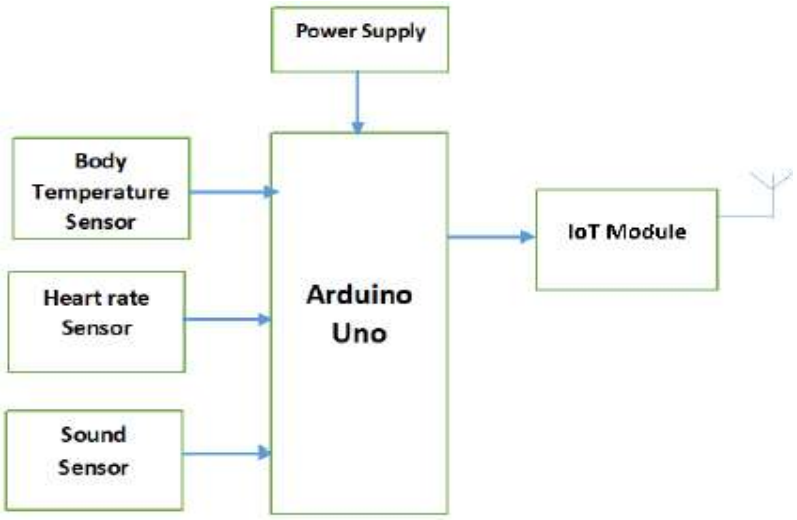

Figure 1: Animal section of cloud information

Field Section:

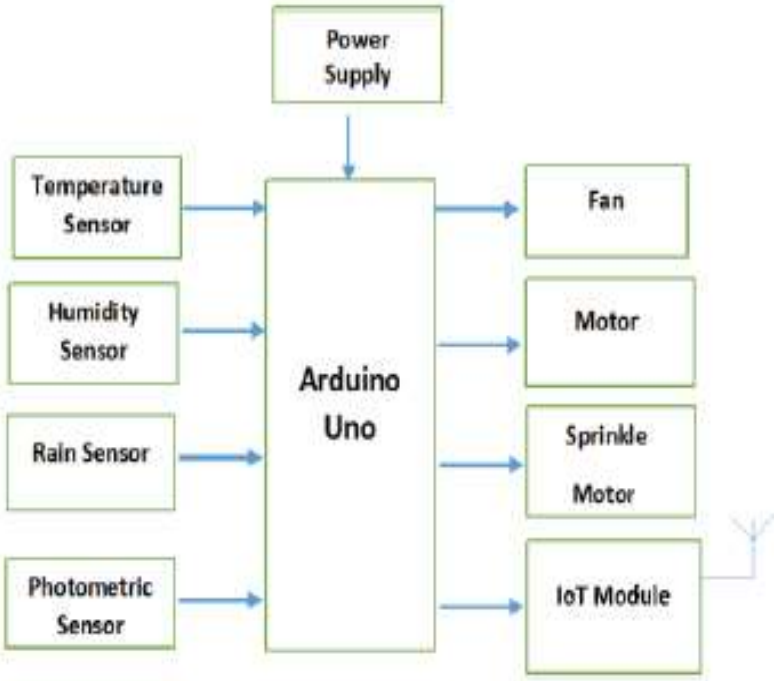

Figure 2: Animal section of distributed computing

Image Processing Field section

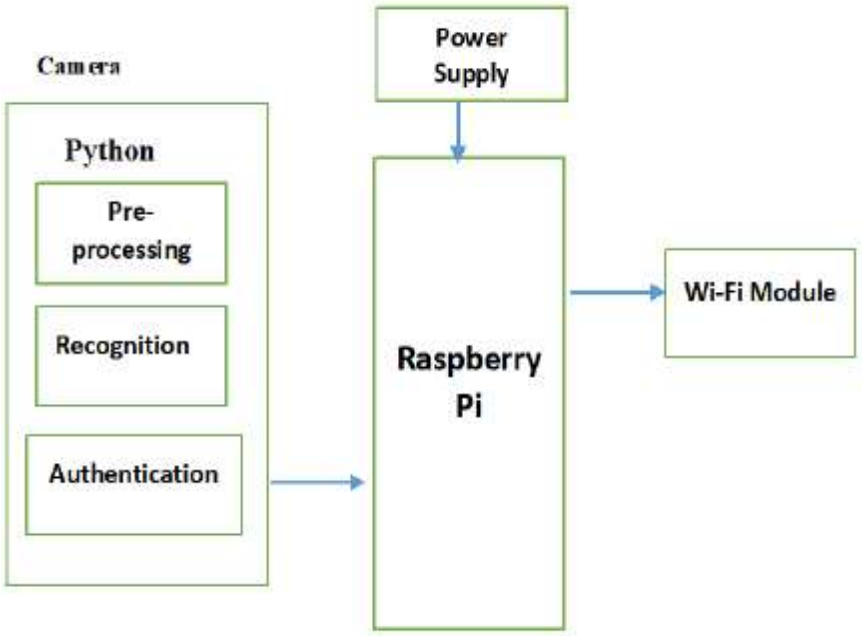

Figure 3: Image Processing Field section of Raspberry Pi

Figure 4: Real time animal care and management

The segment that supplies the necessary +5V to the components is called the power supply. To maintain a stable +5V supply, the IC LM7805 is employed. A transformer is wired in series with the alternating current (220V) to reduce the voltage before it is converted to direct current (dc). After being converted to dc by a simple capacitor filter, the alternating current (ac) voltage from a diode rectifier can be used directly. Ripple or ac voltage variation is typically present in the resulting dc voltage.

5. RESULT AND DATA ANALYSIS

The system's primary goal is to let animal administrators take better care of and more

systematically manage their charges by automating various time-consuming animal care tasks using AI and IoT. Reduce energy consumption and improve animal tracking and real-time visualization systems.

To implement this approach used following components

5.1. Hardware device

This is the Arduino Board, which is regarded as the system's controller. In the context of the internet of things, it is a straightforward and inexpensive actuator for developing digital gadgets and interactive objects. The optimal platform for this architecture is Arduino, which will carry out local real-time observation. GPS and cameras are also integrated with Arduino. The cameras are used for live surveillance or taking pictures. Additionally, a database is used to hold the animal data. GPS gives the proposed system a network to update data for the Animal Administrator application. With the aid of a GPS system, it will be simpler to find a stray dog that requires medical attention or needs to be neutered because we know that canines have a specific territory where they belong. The architecture uses Raspberry Pi technology since it needs a small computer to track animal activity.

5.2. Database

In this scenario, we select an open-source image dataset to predict and detect the animal for proper tracking using computer vision, and collect data from Kaggle it consists 90 classes of different animals and has 5400 high-resolution images. Link https://www.kaggle.com/datasets/iamsouravbanerjee/animal-image-dataset-90-different-animals.

5.3. Preprocessing

In this work we implement 3 different image enhancement algorithms to improve the feature extraction process for neural networks based on convolutional transfer learning models, then rescale and resize with pixel division normalization ./255.

a) **Image scaling-** A digital image's proportions are changed during the "resizing" process. When an image's size is increased, it gets smaller; likewise, when its size is dropped, it gets smaller. Even while both raster and vector drawings can be enlarged, the outcomes don't appear the same. A technique called image interpolation can be used to magnify or modify images using a one-pixel wide grid. You must first resize the image if you want to change the overall amount of pixels it contains.
b) **Normalization**- It is a method of merging two pixels so that there is no change in the pixel's intensity value. Its main goal is to convert an image that is used as input into a value that appropriately depicts the feelings the scanned object elicits.
c) **HistogramEqualization-**The process of histogram equalisation is used in image editing to adjust the contrast of a photo by fiddling with the histogram's distribution of

intensity. The goal of this method is to improve performance by introducing a linear trend into the cumulative probability function related to the image.

d) **Contrast Enhancement-** By raising the brightness difference between the items and the backgrounds in which they are placed, contrast enhancements can make objects in the image more perceptible. However, it is possible to combine both of these stages into a single phase. Normally, contrast enhancements consist of a contrast lengthen followed by a tonal enhancement.

e) **Log Transformation-** The most popular technique for converting data that deviates from the normal distribution into data that is more akin to the normal distribution is the logarithm transformation. The transformed data will follow a normal distribution or one that is substantially identical to it if the original data follows a log-normal distribution or one that is nearly identical to it.

5.4 Transfer Learning Model for detection and prediction of Animals

In this work, we use various models for best fit to classify and predict animal class using Arduino device and camera. The model used DenseNet169, Inception V3, Xception Net and VGG16.

Table 1: Hyper parameters details

Model	DenseNet169, Inception V3, Xception Net and VGG16
Learning Type	Transfer Learning
Weights	Image net
Shape	128*128*3
Layers	Conv2D, Dropout
Pooling	Global Average pooling
Normalization	Batch Normalization
Activation	Relu
Output Function	Softmax
Optimizer	Adam
Learning rate	0.02
Loss	Categorical Cross Entropy
Metrics	Accuracy, Loss

5.5. Performance Evaluation

To evaluate the performance of all models use Accuracy, precision, recall, and f-measure with loss. Following table shows the final output of the proposed models.

Table 2 Performance comparison between models

Model	Accuracy	Precision	Recall	F-Measure	Loss
DenseNet201	98.42	97.54	99.87	97.23	0.0012
Inception V3	97.32	94.67	95.38	96.77	0.038
XceptionNet	95.11	93.45	94.59	93.46	0.090
VGG16	90.32	89.78	88.35	92.74	0.20

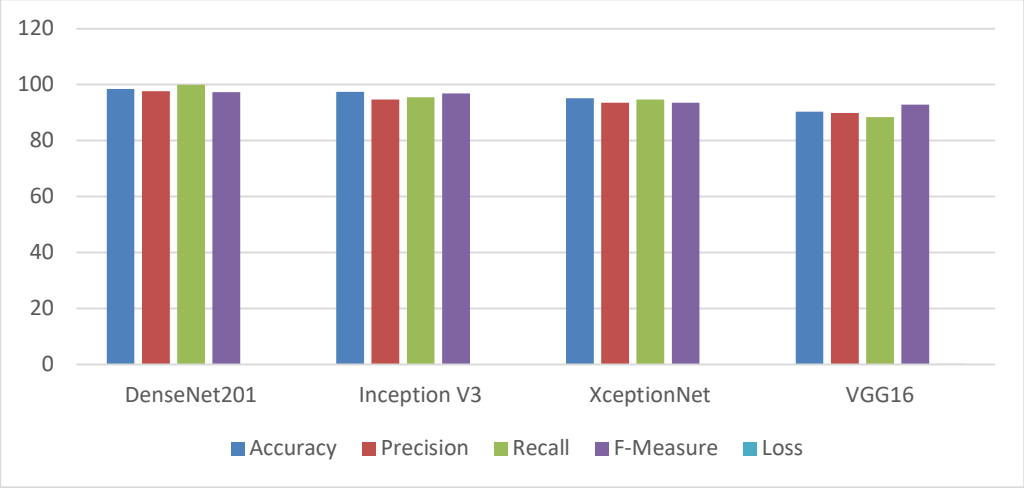

Figure 5: Accuracy and loss graph of DenseNet201

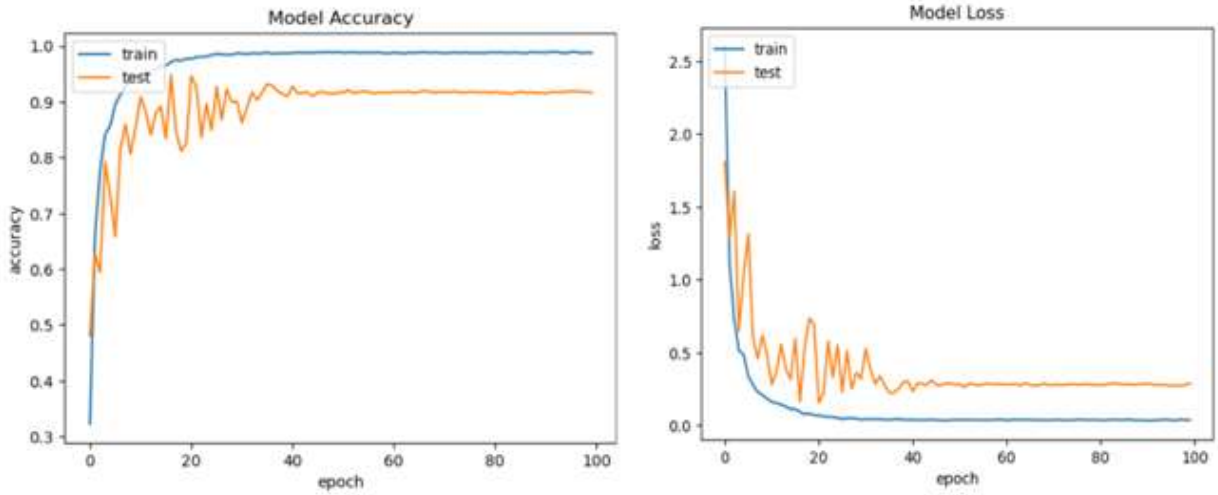

Figure 6: Prediction for accuracy and loss of train and test

Prediction

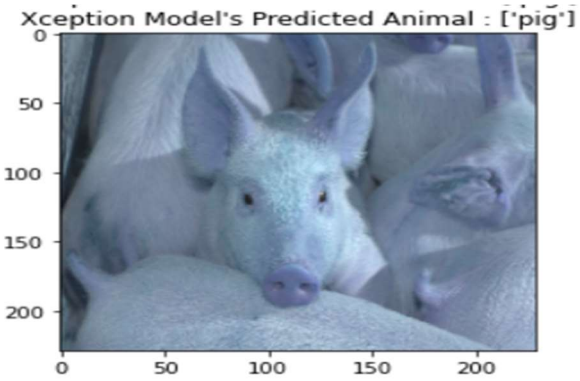

Figure 7: Predicted animal 'Pig' of xception model

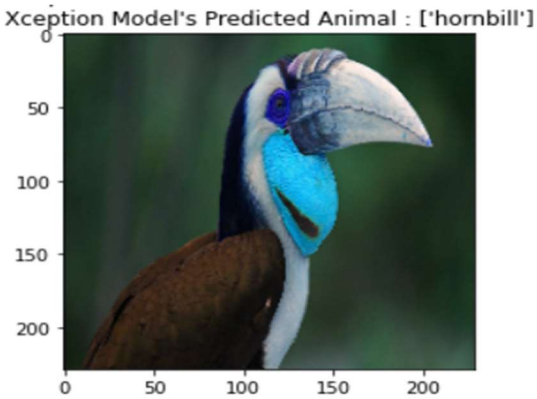

Figure 8: Predicted animal 'hornbill' of xception model

Figure 9: Predicted animal 'swan' of xception model

6. CONCLUSION

This study presents an enhancement design for the savvy animal board's framework using IoT and AI based on consideration & board of creatures in zoos. Beacon systems, WIFI communities, and Arduino will all make use of this technology in tandem. Communication technologies like the Raspberry Pi, AI, and cloud databases and distributed computing. IoT & AI automate some cumbersome methods of animal care, allowing animal organisations to consciously consider or oversee animals in areas such as temperature regulation, behaviour, and environmental control. This study's recommended framework is still in its infancy; there are many areas that need more consideration & updates to properly handle the Zoo's problems.

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