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ARTIFICIAL INTELLIGENCE BASED PET MONITORING SYSTEM

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Abstract

To achieve the goal of ensuring pet safety more efficiently and effectively than ever before. A pet monitoring system based on AI can provide real-time insights on your pet's environment, by continuous monitoring and analyzing data from cameras, AI algorithms can detect anomalies and provide a frequency-feedback based on the input received from the camera. This project aims to develop a comprehensive pet monitoring system that utilizes AI to provide a range of benefits to both pets and their owners. With AI-powered pet monitoring systems, we can create a safer, healthier, and happier environment for our pets. AI can process vast amounts of data and identify patterns and trends that would be difficult or impossible for humans to detect in the long run. This paper follows a systematic approach for reviewing compendium of literature to explore the current research in this field. It has been identified that these smart devices as the primary objects to replace the requirement for human monitoring, and thus having an essential role in this paradigm.

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I. INTRODUCTION

Pets, like humans, face a variety of risks that can impact their health, safety, and well-being. Some common risks to pets include.

Accidents: Pets are at risk of accidents such as falls, collisions, and drowning

Toxic substances: Pets can be exposed to toxic substances such as chemicals, medications, and household plants, which can cause serious health issues.

Emotional stress: Pets can experience emotional stress due to changes in their environment, lack of socialization, or other factors.

Anxiety in dogs has turned out to be a huge issue when concerned with dog's health. Dog Appeasing Hormone (DAP) is a synthetic version of a hormone produced by lactating female dogs. The hormone, which is released by the mother during nursing, helps to calm and soothe her puppies, promoting feelings of security and reducing anxiety. DAP has been found to have a similar effect on adult dogs and is commonly used in the form of diffusers, collars, and sprays to help calm dogs in stressful situations. By providing a sense of security and calm, DAP can help to improve the overall well-being of dogs and promote a happy and healthy relationship between dogs and their owners.

These dog appeasing hormones can also be generated using various methods. Here we are using audio frequencies to manipulate the production of it.

II. LITERATURE SURVEY

Based on the literature survey done and analysing all the premises for the feasibility. Main abstract gained from the survey includes.

Training pets based on frequency:

Based on the study *"The effect of music on the behaviour of dogs" by Deborah L. Wells.* **Oxytocin levels** in dogs can be altered in pets by playing specific music.

The 400-440 Hz frequency of classical music is known to generate calming effects in pets as well as in humans.

The 20,000 – 25,000 Hz frequency range is proven to be disturbing to pets and it is the frequency used in digital dog whistles and other dog repellent devices.

Based on *You Only Look Once: Unified, Real-Time Object Detection" by Joseph Redmon et al. (2016)* proposing a real-time object detection system that uses a single neural network to predict bounding boxes and class probabilities for detected objects.

A Survey on Intelligent Pet Monitoring Systems for Well-Being and Health Monitoring" by H. Jeong et al. (2021): This survey paper provides an overview of

intelligent pet monitoring systems that use AI and IoT technologies for pet well-being and health monitoring. The authors discuss the different types of sensors and algorithms used in these systems, as well as the challenges and future directions in this field

"A Survey on AI-Based Pet Health Monitoring" by L. Gao et al. (2021): This survey paper provides an overview of AI-based pet health monitoring systems that use machine learning algorithms to analyze pet and health data.

"A Review of AI and Machine Learning Techniques in Pet Monitoring Systems" by E. K. Tum et al. issue (2021): This review paper provides an overview of AI and machine learning techniques used in pet of a monitoring systems.

"A Comprehensive Review of Wearable Technology for Pet Monitoring and Well-Being" by C. Smith et al. (2021): This review paper provides a comprehensive overview of wearable technology for pet monitoring and well-being.

" AI-Based Pet Monitoring and Smart Feeding

System" by Y. Chen et al. (2020): This paper presents an AI-based pet monitoring and smart feeding system that uses machine learning algorithms to of analyze pet

behavior and adjust feeding schedules accordingly.

"A Comparative Study of Pet Monitoring Systems: Wearables vs. Smart Homes" by R. Sharma et al. (2021): This comparative study compares the performance and features of pet monitoring systems using wearables and smart homes.

"A Review of Pet Monitoring Systems for Outdoor Environments" by J. H. Lee et al. (2021): This review paper provides an overview of pet monitoring systems designed for outdoor environments.

"Smartphone-Based Pet Monitoring Systems: A Review" by A. Kim et al. (2021): This review paper provides an overview of smartphone-based pet monitoring systems.

A. Existing Traditional methods

The traditional method of monitoring pets includes manual supervision from the owners in the vast majority. Other automated solutions include

Pet Cameras: Pet cameras are a popular solution for pet monitoring. These cameras allow pet owners to watch their pets remotely through a mobile app or website. Some pet cameras even have two-way audio and treat dispensers, allowing owners to interact with their pets while they are away.

GPS Trackers: GPS trackers are another popular solution for pet monitoring, particularly for outdoor pets. These devices attach to a pet's collar and allow owners to track their pet's location in real-time through a mobile app.

Activity Trackers: Activity trackers are designed to monitor a pet's activity level and provide information about their exercise habits.

III. PROBLEM STATEMENT

The Problem statement is identified and discussed below.

A. Problem statements

Time and availability: Constant monitoring of pets requires pet owners to be available around the clock, which can be difficult if the owner has a busy schedule or other commitments.

Cost: Some pet monitoring devices or services can be expensive, which may not be feasible for some pet owners. This can result in a lack of monitoring or a reliance on less accurate or lower quality monitoring methods.

Psychological impact: Constant monitoring can also have a psychological impact on both the pet and the owner. For the pet, it may lead to stress or anxiety, while for the owner, it can result in a sense of constant worry or overprotectiveness.

In attempt to address all these issues faced by the pet owners. There is a requirement of a reliable and automated system for monitoring the pets. Which would substitute the required manual supervision.

IV. PROPOSED SOLUTION

High frequency sounds can be used to disturb dogs and, in a way, train them or keep them away from doing specific things they are not supposed to do and even induce DAP production.

As the animal's hearing range is much wider than that of humans. Dogs can hear sounds in the frequency range of 20 Hz to 65,000 Hz, whereas humans can only hear sounds in the frequency range of 20 Hz to 20,000 Hz.

A pet Custodian or a pet food monitoring system through a dog collar that uses artificial intelligence (AI) can help solve this problem by cautioning or training your pet through the process of **reinforcement learning**

Ultrasonic sound generators These are devices that emit high frequency sounds in the range of 20,000 Hz to 25,000 Hz, which are above the range of human hearing. These sounds are designed to be unpleasant to

dogs, and can be used to deter them from approaching or barking

V. METHOD AND MATERIALS

The prototype involves analysing the pet's environment and produce the necessary audio frequency to mend or encourage the behaviour and activity of the pet accordingly.

A. Ultrasonic audio frequency generators

For implementation of the proposed solution, ultrasonic audio frequency technique is used. As the animal hearing range is much wider than that of humans. Pets can hear sounds in the frequency range of 20 Hz to 65,000 Hz, whereas humans can only hear sounds in the frequency range of 20 Hz to 20,000 Hz. Research has suggested that sound frequencies in the range of 432 Hz and 528 Hz can have a calming effect on the mind. These frequencies are sometimes referred to as "healing frequencies" and are thought to promote relaxation, reduce stress and anxiety, and improve overall well-being. Thus, can bring our pets from a agitated to calm and composure. On the other hand, the audio frequencies in the higher range can have acute and immediate withdrawal and submission effect from animals.

B. Materials involved

The prototype is made cost-efficient with the help of sensors and process. To predict the environment we need a pinhole camera to monitor the surroundings of the pet .For programming the prototype, AtMega328P microcontroller is used. This microcontroller is known for its reliability and low-costs. To display the result, we make use of the Bluetooth transmitter to access the remote using a external device. With the use of these low-cost reliable materials, The pet monitoring prototype can monitor pets non-invasively at low-costs.

Device	Amount
Arduino Uno	1
Wires	2 sets
Digital pin camera	1
Breadboard	1
Bluetooth HC-06	1
External comm device	1

***Table 1**: Components involved in the prototype*

VI. DESIGN

A. Modelling the prototype

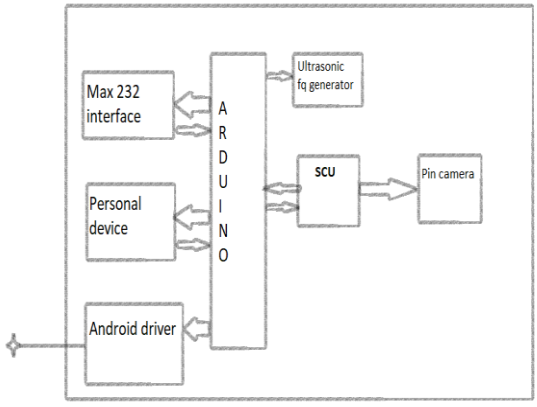

***FIG 1**: The Circuit level Modelling diagram that shows the arrangement of the camera through SCU*

arduino, and max232 interface for programming and the ultrasonic generator for frequency generation

The materials for the prototype are modelled by a System on a Chip(SoC) with the arduino board acting as the platform. The sensors are arranged on the circuit diagram in a manner to act as a input interface for the system. The arduino platform holds the AtMega328P microcontroller that acts as the main processor of the pet monitoring system prototype. The microcontroller is interfaced with the input sensors with the help of SCUs - System Control Units. Then for programming the microcontroller, the Max-

232 interface is used for writing the instructions to the arduino board. The entire prototype is designed in a way that meets the circuit level model with the user level design.

VII. IMPLEMENTATION

The implementation process of the pet monitoring system prototype starts with collecting the data for training the AI model for sensing various toxic environment and objects. Then the data collected, is processed with the help of microcontroller chip.

The microcontroller chip is first programmed with the instructions also, the microcontroller is responsible for predicting the resultant output from the input provided by the camera

A. Collection of data

Collecting data to train an AI model is important because the performance and accuracy of the model is largely dependent on the quality and quantity of data used to train it. The process of training an AI model involves feeding it large amounts of data, and then allowing the model to learn patterns and make predictions based on that data. Here to detect specific objects various the coco128 data set is used. To identify the aspects of the environment such as presence of things that could harm the pets. Presence of materials such as Nicotine laden cigars and other such materials can be easily identified by training the Artificial Intelligence through the process of Machine Learning. Once the model is trained and ready to take on and process the data the prototype can now process the data that its is intended to. The basic training for the AI model is done using the coco128 dataset. The data contains the mapped and weighted files to train the model appropriately.

The more data the model has access to, the more accurately it can recognize patterns and make predictions. Additionally, the quality of the data is also important, as the model will learn from the examples it is given. If the data is biased, incomplete, or inaccurate, the model may make incorrect predictions or exhibit biased behaviour.

B. Data Labelling

Custom data to be trained must be labelled manually and be given to the training model. Once the AI model is trained using the labelled data it can identify similar patterns when provided in the detect function.

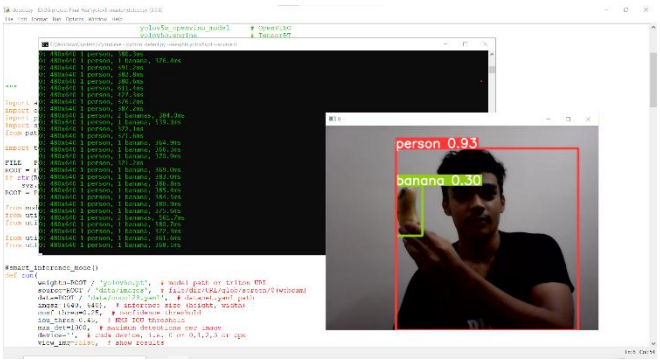

***FIG 2**: The Mapping and Labelling training data*

C. Processing the data

After the data is collected through camera or a physical input through the external remote the microcontroller is programmed with the command to trigger the ultrasonic frequency generator. The microcontroller is also programmed with the prediction models (i.e.) the AI. The programming instructions are embedded into the microcontroller chip with embededC. Once the AI detects any anomalies in the situation of the per then the sound frequency generation is triggered.

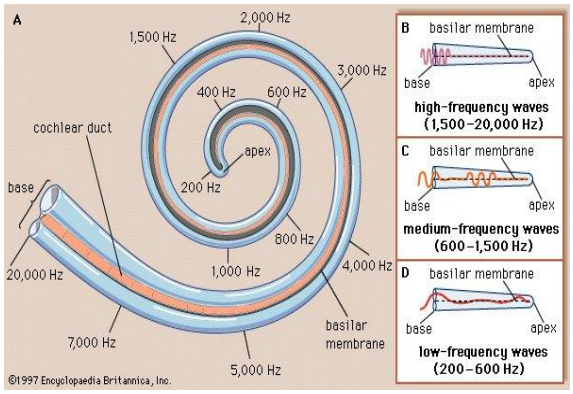

***FIG 3**: The image shows the dependency of frequency of the sound travelling through the ears.*

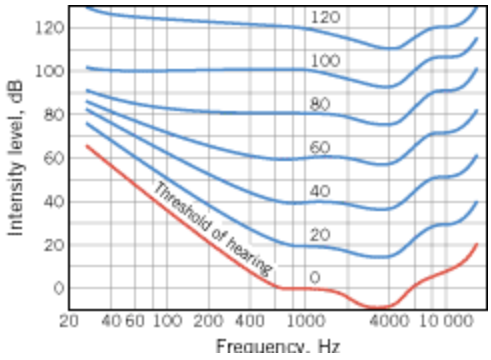

***FIG 4**: The image shows the hearing threshold of the ear.*

D. Accuracy of the model

After the process of data collection and processing of the data. The AI model was tested for its accuracy and the results were noted and modulated and categorised based on various specifics.

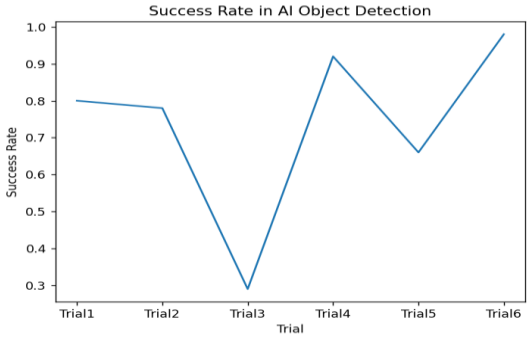

***FIG 5**: The image shows the trials of tests conducted.*

VIII. PILOT STUDY

A pilot study is made on a controlled environment to test the object detection and the success rate of it respectively. Everyday objects were detected using the YOLO model and the results have been captured and presented. The AI model which was trained using the obtained data sets was put to test in the environment it need to work in and the model was tested under various constraints. The success rate and the rate of generation of the correct frequency was tested in all these conditions that was mentioned.

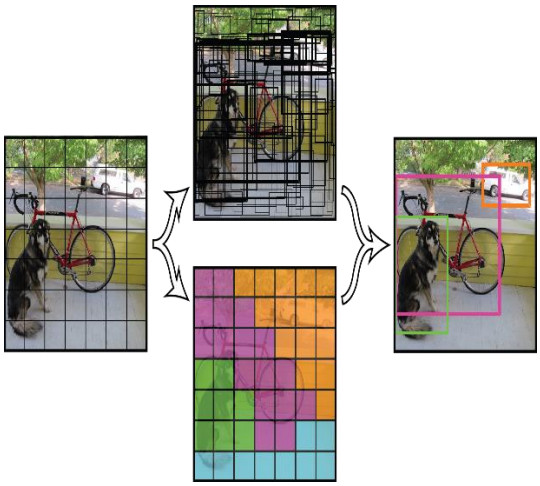

***FIG 6**: The image shows the detection of objects by the AI model.*

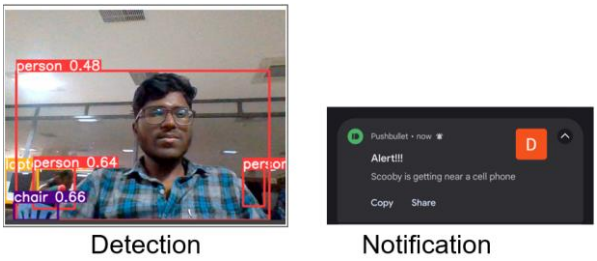

***FIG 7**: The image shows the detection by the AI model.*

IX. RESULT AND ANALYSIS

The results obtained from pilot study are analysed with desired results that are needed by the users. The users validate the prototype as a legitimate device.

X. CONCLUSION

Thus the prototype holds 90% accuracy in the process of generation of the required ultrasonic frequencies to maintain the pets in the absence of the owners. The AI models seems to hold up-to a 95% accuracy in detection of the objects and the pet environment. Both the negative and positive feedbacks from the pets were observed duly and the desires functioning was obtained.

FUTURE DEVELOPMENTS

The prototype can be implemented into a full-scale product for mainstream dog monitoring. It can additionally implement.

- Feeding automation
- Activity and health monitoring
- Pet communication feature

These two features can broadly increase the application premises for the prototype.

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