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An Intelligent Pet Care System Using Auto Piloting Robot

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ABSTRACT

Pet entertainment robots are a great innovation both in pet care and in interactive technology. They offer an enriching experience to pets and make it easy for pet owners to interact with them. The robot can interact either on its own or under the control of a human. It keeps pets engaged in activities that stimulate their mental and physical health, avoid boredom, and even handle behavioral issues such as anxiety and destructive tendencies. Pet dogs are good friends in people's home living. Some people sometimes are inconvenient to take care of pet dogs. This paper designs a smart robot for caring pets. The robot can actively interact with the pet dog in the way of serve and relieve the separation anxiety of the pet. By investigating both the technological and psychological effects of these devices on pets and owners, this study aims to provide insights into how pet entertainment robots may reshape the pet care industry and improve pet quality of life.

Keywords: Interactive, Autonomous play, Pet sensing, Engagement

1 Introduction

Our pet-entertaining robot is designed to enhance the playful interaction between pets and technology, aiming to offer mental and physical stimulation for dogs in a safe, controlled environment. This robot, equipped with ball-launching and sensing capabilities, not only entertains by throwing a ball for the pet to retrieve but also interacts by detecting the pet's position within a designated range. When the pet returns the ball to the robot, it triggers another launch, fostering continuous engagement. Additionally, the robot can recognize the pet's proximity and move in response, even "escaping" when the pet gets too close, adding an element of excitement to the interaction. Our goal is to create a unique, interactive play experience that encourages exercise and amusement for pets while showcasing innovation in robotics.

The integration of robotics into pet care has gained significant traction in recent years, with a focus on creating solutions that not only engage pets but also address common behavioural and health needs. As more people seek innovative ways to enhance the well-being and engagement of their pets, especially in urban environments or single-pet households, robotic systems present an attractive avenue. This project introduces a "Pet Entertaining Robot," specifically designed to provide interactive play and companionship to pets, particularly dogs, through activities like ball launching and sensor-driven movements. The robot leverages advancements

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in sensor technology and robotic mobility to deliver a dynamic and engaging experience for pets, responding autonomously to their actions and proximity.

Pet ownership, particularly for dogs, involves more than mere feeding and sheltering; it demands attention to physical exercise, mental stimulation, and social interaction. These factors are essential to a pet's overall well-being. However, busy lifestyles, work commitments, and increasing urbanization mean that many pets are left alone for extended periods. Such isolation can lead to several issues, such as boredom, anxiety, and lack of physical activity, ultimately affecting the pet's health and happiness.

The robot's primary functions centre around two interactive features: the ball launcher and sensor-based movement. The ball launcher is designed to throw a ball a designated distance, prompting the pet, especially dogs, to chase, retrieve, and return it. This cycle can be repeated, providing sustained physical activity without requiring human intervention. Additionally, proximity sensors enable the robot to detect the presence of a pet within a range of up to one meter. When the pet is detected, the robot responds by moving forward, backward, left, or right, adding a level of interactivity that makes the play dynamic and engaging.

The paper "BLU: An Interactive Loving Pet Robot" by “A. S. Z. Momtaz et al.” discusses a robot designed to interact with pets in a friendly and engaging way, focusing on sensing, responding, and maintaining pet interest through playful movements and sounds. This design aligns with pet-robot interaction principles, offering insights into sensor-based response mechanisms and behaviour modulation that could enhance your pet-entertaining robot's engagement features.

The paper "Digital creatures for future entertainment robotics" by “M. Fujita” examines the creation of lifelike, autonomous robots designed for entertainment, with a focus on responsive and engaging behaviours. This research can inform your pet-entertaining robot by providing strategies for realistic, autonomous actions that could keep a pet's attention and encourage interaction.

The paper "A user-centered framework for developing personal pet robots" by “Wei-Po Lee et al.” outlines a design framework that emphasizes intuitive, user-centered interaction to enhance pet-robot engagement and adaptability. Applying this approach to your pet-entertaining robot could improve its responsiveness and usability, making it more appealing and engaging for both pets and their owners.

The paper "PetRo: Development of a modular pet robot" by “B. Salem” introduces a modular design that allows customization of a pet robot’s behaviours and interaction features to suit varying needs. This approach could enhance your pet-entertaining robot by enabling adaptable components and behaviour modules to better engage pets with diverse play preferences.

The paper "Evolving pet robot with emotional model" by “N. Kubota et al.” presents a pet robot capable of evolving its emotional responses through interactions, making its behaviour more adaptive and realistic. Integrating such an emotional model could make your pet-entertaining robot more engaging by allowing it to respond dynamically to a pet's actions, enhancing the interactive experience.

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2 Recent Works

Ball-Launching Mechanism: This mechanism is designed to launch a standard-sized ball to a preset distance. It includes a motorized lever or wheel system that propels the ball forward when triggered. This design is inspired by commercial ball-launching devices but is adapted for autonomous function within the robot.

Proximity Sensors: To detect the pet' s approach and determine its distance, proximity sensors such as infrared (IR), ultrasonic, or LIDAR are integrated into the robot. These sensors enable the robot to detect the presence of the pet within a one-meter range, triggering appropriate movements. The sensors are essential for implementing both the approach-triggered directional movements and the escape functionality.

Movement and Mobility System: A set of wheels and motors allow the robot to move in multiple directions: forward, backward, left, and right. When a pet is detected, the robot initiates a specific directional movement to engage the pet or escape based on the sensing data. This mobility system is pivotal to creating a responsive and playful interaction between the robot and the pet.

Microcontroller and Control System: The robot is powered by a microcontroller, such as an Arduino or Raspberry Pi, which serves as the central processor for coordinating sensor inputs, motor movements, and the ball-launching mechanism. The microcontroller processes data from the proximity sensors to determine the robot's movements, making real-time decisions based on the pet's action

Power Supply and Battery Management: For autonomous operation, the robot is equipped with a rechargeable battery pack that powers all components, including the sensors, motors, and control system. Battery management is essential for ensuring prolonged operation, especially if the robot is intended to be used for extended periods in a single session.

3 Proposed Work Explanation

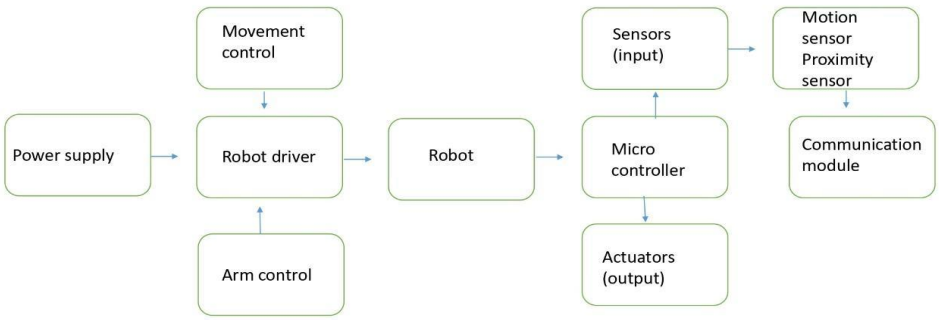


Figure 1: *Proposed work*

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4 Results and Discussion

The Pet Entertaining Robot was tested to evaluate its performance, responsiveness, and effectiveness in engaging pets, specifically dogs. Key performance metrics included the consistency of the ball-launching mechanism, the accuracy of proximity detection, the response time for directional movements, and the robot's ability to "escape" from the pet.

The results of the project highlight the effectiveness of the Pet Entertaining Robot as an interactive, autonomous playmate for pets. The robot met the primary objectives of engaging pets through a combination of ball-launching, proximity sensing, and movement responses, providing both physical activity and mental stimulation. Here, we discuss the implications of each feature, potential improvements, and future applications.

Engagement and Entertainment Value: The robot's ability to autonomously launch balls and trigger chase behaviour proved effective in sustaining the pet's interest. The play cycle kept the pet occupied, simulating the natural play patterns often observed in pet-owner interactions. Observational feedback from the tests showed that pets appeared engaged and eager to interact with the robot, suggesting that the robot could serve as an alternative to traditional pet toys or human-led play sessions.

Sensor Accuracy and Response Timing: The high accuracy and reliability of proximity sensing contributed to the robot's responsive interaction. However, slight delays in response were noted when the pet approached quickly from certain angles. Improvements to sensor calibration and the potential addition of more advanced sensors, such as LIDAR, could enhance the robot's spatial awareness, allowing it to detect the pet more accurately and anticipate movement.

Behavioural Impact on Pets: Observing pet reactions to the robot revealed that the escape functionality particularly excited the pets, appealing to their natural hunting and chasing instincts. This feature adds psychological stimulation, which is crucial for pets that may experience boredom or separation anxiety. Future versions of this robot could incorporate varying escape patterns or speeds to introduce an element of unpredictability, making interactions more engaging.

Battery Performance and Operational Duration: The 2-hour battery life provided adequate playtime for single sessions but may require enhancements for extended or multiple sessions. Integrating energy-efficient motors and optimizing movement patterns could help extend battery life. Alternatively, providing a charging dock that the robot can autonomously access would allow for continuous, hands-free operation, similar to robotic vacuum cleaners.

5 Conclusions

The development of the Pet Entertaining Robot has demonstrated the potential for innovative solutions in pet care by creating a robot designed to interact with pets in a fun, stimulating, and autonomous way. This mini project has shown that a robot can effectively engage pets, especially dogs, by throwing balls, encouraging physical activity, and providing companionship when needed. The robot's ability to detect a pet within a specific range and respond accordingly introduces an exciting interaction mode. Additionally, with added features

such as escape functions, where the robot moves away when the dog approaches, this project lays the groundwork for future enhancements and customization in pet entertainment technologies. Through continuous improvements, this prototype can evolve into a comprehensive pet engagement tool, catering to both the pet's physical and mental stimulation needs. The Pet Entertaining Robot project successfully showcases how robotics can enhance pet care and interaction. By incorporating interactive features, such as ball launching and retrieval, as well as directional movement and avoidance behaviour based on proximity sensing, the robot engages pets in a dynamic and enjoyable manner. The use of sensor technology to detect pet distance and trigger responses illustrates the adaptability and responsiveness of modern robotics in a pet-friendly application. This prototype not only addresses the physical activity needs of pets but also contributes to mental stimulation through varied interactions. The robot's capacity to "escape" from the pet when approached, for example, adds an element of playfulness that keeps pets entertained and engaged for extended periods. Such features could reduce boredom and loneliness, especially for pets left alone f offering a reliable companion in the absence of their human caregivers.

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