



Animal Safety and Welfare Using IOT

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ABSTRACT

The Internet of Things (IoT) has revolutionized the ways we monitor and ensure the safety and welfare of animals. Focusing on pets, livestock, and wildlife, this article provides an in-depth review of IoT-based solutions aimed at promoting animal well-being. We explore a wide range of IoT sensors and devices that track health, activity, and environmental conditions, enabling early detection of stress, illness, and potential safety risks. Additionally, IoT-enabled tools for monitoring animal location, movement, and social interactions are examined. The article also discusses how machine learning and data analytics can process IoT data to inform animal care decisions. Highlighted are successful IoT applications in animal welfare, including smart veterinary care, wildlife conservation, and precision livestock management.

Keywords: Authors are advised to write 3-5 keywords related to the article, separated by comma. These keywords will be used for indexing purpose.

1 Introduction

The welfare and safety of animals have become a growing concern globally, with increasing awareness of the impact of human activities on animal well-being. [1], [2] & [3] The Internet of Things (IoT) has emerged as a transformative technology with vast potential to improve animal safety and welfare. By harnessing the power of IoT, we can revolutionize the way we monitor, manage, and care for animals across various settings, from farms and zoos to wildlife reserves and domestic environments [4] & [5].

[6],[7]& [8]IoT-enabled solutions offer real-time monitoring, data-driven insights, and automated decision-making capabilities, enabling us to: Enhance animal health and well-being, Prevent cruelty and mistreatment, Improve living conditions and habitats, Streamline animal care and management processes, Promote conservation and sustainability



2 Recent Works

Numerous studies and projects have explored the application of IoT technologies to improve animal safety and welfare. Here, we summarize key findings and trends in the existing literature:

Increased use of wearable devices and sensors for real-time monitoring. Integration of machine learning and data analytics for predictive insights. Growing focus on animal behavior and social monitoring. Expansion of IoT applications beyond livestock to companion animals and wildlife. Emphasis on improving animal welfare and reducing cruelty

3 Proposed Work Explanation

Human-wildlife conflict, road accidents, habitat fragmentation, poaching, climate change, Proposed Model as shown in Figure 1, IoT-Based Animal Welfare System with Arduino

3.1 Arduino Software

The Arduino IDE enables easy coding, compiling, and uploading for various Arduino boards. With features like syntax highlighting, code completion, and debugging, it supports efficient development. Available in classic (1.x) and improved (2.x) versions, it's compatible with Windows, mac OS, and Linux.

3.2 ESP8266 Microcontroller

The ESP8266 is an affordable, Wi-Fi-enabled microcontroller suited for IoT. Compact and low-power, it has extensive community support and is programmable via Arduino and Micro Python. Common modules include ESP-01, ESP-12, and Node MCU.

3.3 Ultrasonic Sensor (HC-SR04)

The HC-SR04 provides precise, non-contact distance measurement up to 4 meters, with ± 3 mm accuracy. It operates on 5V and is compact, ideal for distance sensing projects.

3.4 Buzzer

A passive buzzer requires an external oscillator and is economical, energy-efficient, and works across various voltages.

3.5 LED

LEDs offer high energy efficiency, long life, minimal heat, and are ideal for directional, low-power lighting.

These components, combined with Arduino, create a robust platform for IoT animal monitoring and welfare

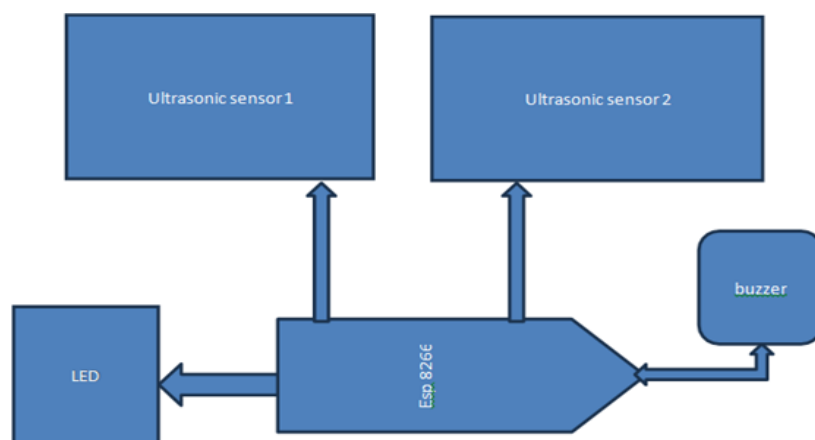


Figure 1: *Proposed block diagram*

4 Results and Discussion

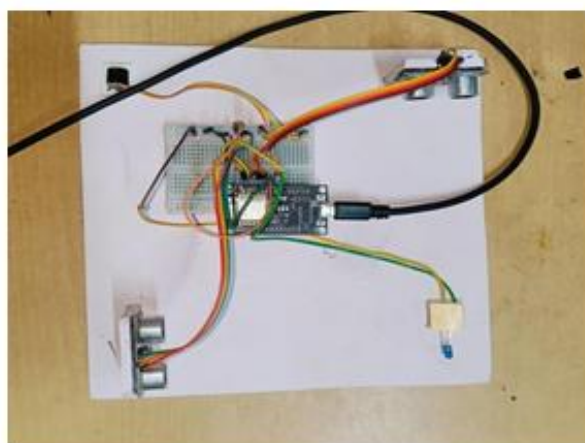


Figure 2: *Demo Model*

As an animal moves out of the forest and approaches a sensor positioned near the fencing, the system detects its presence and initiates a series of alert mechanisms designed to notify and respond swiftly to animal movement near sensitive boundary areas as shown in Figure 2 & 3.

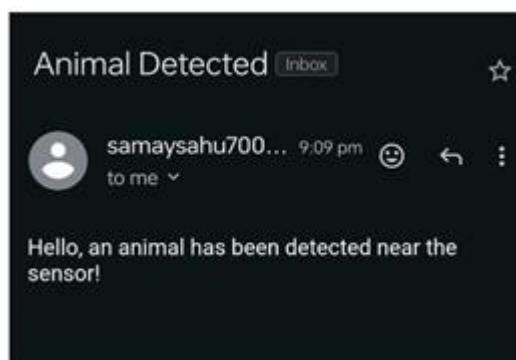




Figure 3: Display

The ultrasonic sensor, strategically installed at the forest's edge, senses the proximity of the animal once it comes within range. This triggers a series of actions intended to signal both humans and the animal itself.

Upon detection, the system activates an audible alert by sounding a buzzer. This sudden noise serves as an immediate deterrent, helping to prevent the animal from approaching further. At the same time, an LED light turns on, providing a bright, visible alert that is especially useful in low-light conditions, allowing nearby personnel or passers-by to quickly notice the movement. This combination of sound and light is aimed at enhancing the visibility of the animal's activity, offering real-time awareness to those nearby.

Additionally, the system sends an automatic notification email to designated recipients, ensuring that those responsible for monitoring the area are promptly informed. The email contains details of the event, including the time and location of the detection, to aid in tracking animal movements and responding if necessary. This multi-layered alert system—combining auditory, visual, and digital notifications—provides a comprehensive approach to monitoring animal movement near the forest boundary, helping to protect both wildlife and human activities around the area.

5 Conclusions

The conclusion of a manuscript should concisely present the study's main findings, highlighting its significance, applications, limitations, and suggestions for future research. It reinforces the research value by summarizing outcomes relevant to real-world applications or policy. Limitations such as methodological or scope constraints should be briefly acknowledged to maintain transparency. Lastly, recommendations for further exploration or adaptation of results offer directions for continued study or practical use, creating a clear, cohesive end to the work without citations or headings.

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