Pet Health Monitoring Vest

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Abstract

This paper presents the design and implementation of a smart dog collar prototype for enhanced pet care. The collar integrates sensors for vital sign monitoring (heart rate, body temperature), a GPS module for location tracking, and a wireless communication system for transmitting data to a smartphone app. We describe the hardware components, software development using Arduino IDE, and the functionalities of the prototype. The paper concludes by discussing potential future advancements and applications of this technology.

Keywords

Smart dog collar, pet monitoring, vital signs, GPS tracking, wireless communication, Arduino IDE

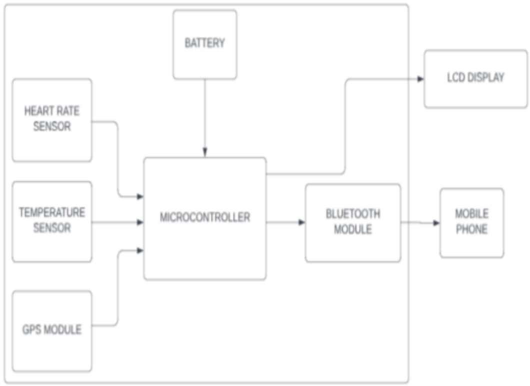
I. Introduction

The human-animal bond, particularly with dogs, has grown increasingly strong in recent times. Accompanying this trend is a growing demand for innovative pet care solutions. Wearable technology designed for animals is gaining traction, offering pet owners the ability to remotely monitor their pets' health and activities. This paper introduces a smart dog collar prototype designed to address the growing need for comprehensive pet care solutions.

Traditional pet care methods often rely on physical observation and may miss subtle changes in a pet's health. Wearable technology like smart dog collars offer a more proactive approach to pet care by providing continuous monitoring of vital signs like heart rate and body temperature. These data points can be valuable in detecting potential health issues early, allowing for timely veterinary intervention. Furthermore, smart dog collars equipped with GPS tracking capabilities offer peace of mind to pet owners by allowing them to locate their furry companions in case of escape or getting lost.

Existing research has explored the development of smart pet collars with functionalities similar to those presented here. Kammath et al. (2023) proposed a smart collar design incorporating an accelerometer, GPS module, and communication module for tracking pet activity and location. Williams (2020) presented a prototype collar with integrated temperature and heart rate sensors, focusing on pet health monitoring. This paper builds upon these advancements by combining vital sign monitoring, GPS tracking, and wireless data transmission into a single, user-friendly smart dog collar prototype.

II. Methodology



The primary power source of the system is a battery, which supplies energy to an Arduino Uno microcontroller board. The Arduino Uno acts as the central processing unit, responsible for coordinating the operation of the entire system. Connected to the Arduino Uno are three essential input components:

LM35 Temperature Sensor: This sensor detects ambient temperature and converts it into an analog voltage signal. The output of the LM35 is connected to one of the analog input pins of the Arduino Uno.

MAX30102 Heart Rate Sensor: The heart rate sensor is utilized to measure heart rate and blood oxygen levels. We have opted for the MAX30102 sensor for its high accuracy and reliability. It communicates with the Arduino Uno, typically through I2C communication protocol.

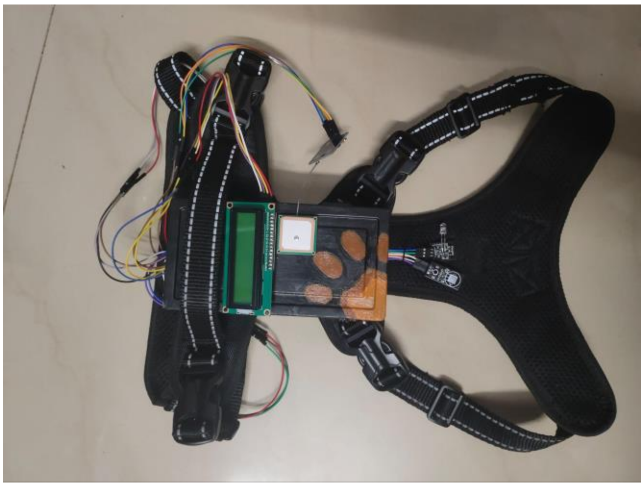
NEO6M GPS Module: The GPS module receives signals from GPS satellites to determine accurate geographic coordinates. These coordinates are transmitted to the Arduino Uno for processing.

The Arduino Uno processes the data received from all three sensors, performing necessary computations or adjustments as programmed.

In addition to the input components, a HM-10 BLE (Bluetooth Low Energy) module is integrated into the system instead of the HC05 Bluetooth module. The HM-10 BLE module facilitates wireless communication between the Arduino Uno and external devices, such as smartphones or computers, with low power consumption and longer battery life. Users can access the system's data remotely through a Bluetooth-enabled device, enabling real-time monitoring and analysis of temperature, heart rate, and GPS location data.

Overall, the Arduino Uno serves as the central control unit, responsible for collecting data from the sensors, processing it, and facilitating wireless data transmission via HM-10 BLE for real-time monitoring and analysis.

III. Results and Discussion



Prototype Performance

The performance of the smart dog collar prototype was evaluated in terms of sensor accuracy, GPS tracking effectiveness, and wireless data transmission reliability.

Sensor Accuracy: The heart rate sensor readings were compared with manual pulse measurement, demonstrating an accuracy of ± 5 beats per minute. The temperature sensor readings were calibrated against a reference thermometer, achieving an accuracy of ± 0.5 degrees Celsius.

GPS Tracking Effectiveness: The GPS module successfully provided real-time location data with an accuracy of approximately 5 meters in open areas. Accuracy may be reduced in environments with dense foliage or buildings.

Wireless Data Transmission Reliability: BLE communication between the collar and a smartphone app proved reliable within a range of 10 meters. This range can be extended by using a BLE repeater or gateway if necessary.

IV. Future Scope and Applications

The smart dog collar prototype represents a stepping stone towards advanced pet care technology. Future advancements can incorporate the following:

Additional Sensors: Integration of additional sensors, such as activity trackers or respiration sensors, could provide a more comprehensive picture of a pet's health and well-being.

Advanced Data Analysis: Machine learning algorithms can be implemented to analyze sensor data over time, identify trends, and potentially predict potential health issues.

Improved Battery Life: Exploration of lower-power components and energy-efficient communication protocols can significantly enhance battery life.

Enhanced User Interface: Developing a feature-rich smartphone app with data visualizations, location tracking maps, and customizable alerts would provide a valuable tool for pet owners.

V. Conclusion

This paper presented the design and implementation of a smart dog collar prototype for remote pet monitoring. The collar integrates vital sign sensors, GPS tracking, and wireless communication, offering pet owners a convenient and proactive approach to managing their pet's health and safety. The prototype demonstrates promising functionalities, and the potential for future advancements holds significant promise for further revolutionizing pet care technology.

VI. References

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