The Intelligent Animal Care and Management System Based on the Internet of Things

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Abstract

The Intelligent Animal Care and Management System Based on the Internet of Things is a comprehensive solution for monitoring and managing animals in a zoo environment. The system uses a range of sensors and an Arduino board to collect and analyze data on environmental conditions, animal behavior, and vital signs. The system includes automated mechanisms for cleaning and feeding animals, providing a safer and more consistent environment for animal care. The proposed system aims to improve the welfare of animals in zoos by providing continuous monitoring of their environment and health, and by automating some of the caretaking tasks. The system has the potential to revolutionize animal care and management in zoos, with implications for animal conservation and education.

Keywords: Animal Care, Arduino Board.

1. Introduction

The increasing number of animals in zoos has made animal care and management a challenging and time-consuming task.An intelligent animal care and management system based on IoT is proposed to automate various aspects of animal care, including monitoring and feeding.The

main objective of the proposed system is to improve the overall welfare of animals in zoos while reducing the workload and stress on animal caretakers.
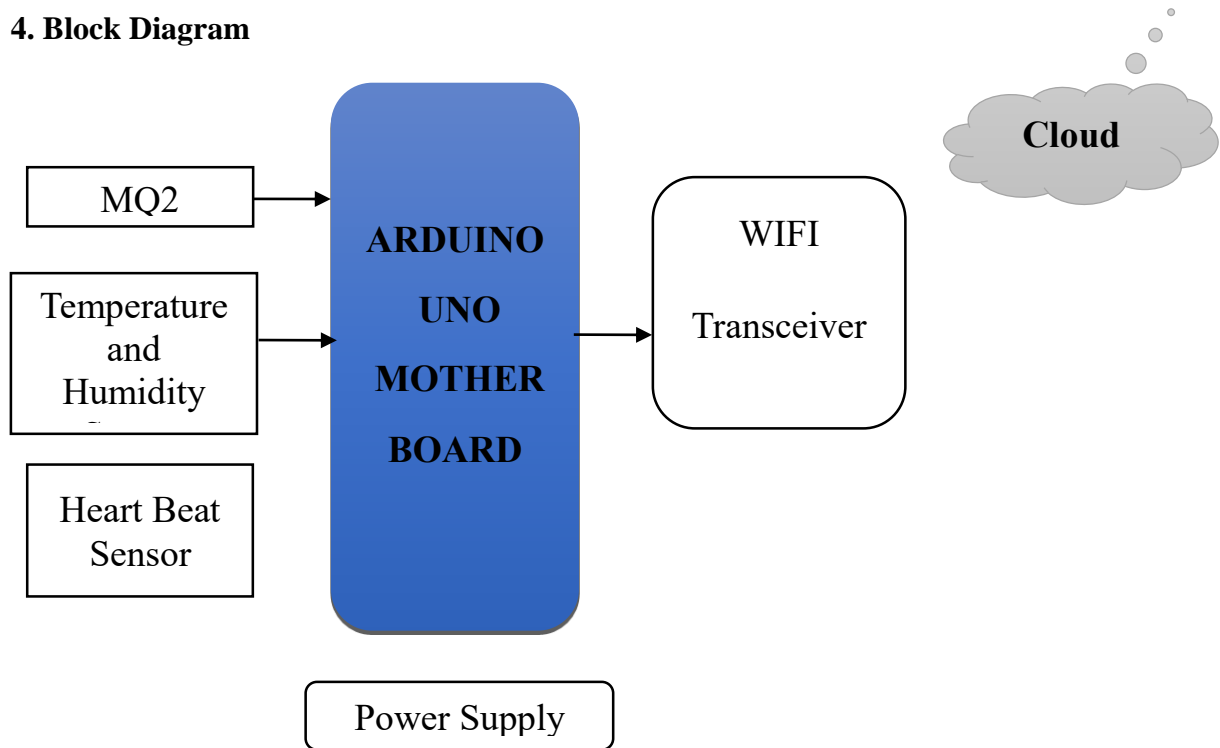
2. Existing System

- *Manual monitoring:* Animal caretakers are responsible for monitoring the health and welfare of animals manually. They need to visually observe the animals and record any changes in their behavior or health conditions.

- *Traditional feeding and cleaning methods:* Caretakers use traditional methods to feed and clean the animal enclosures, which can be labor-intensive and time-consuming.

- *Limited automation:* Some zoos have implemented automation in animal care, such as automatic feeding and watering systems, but these systems are often limited in functionality.
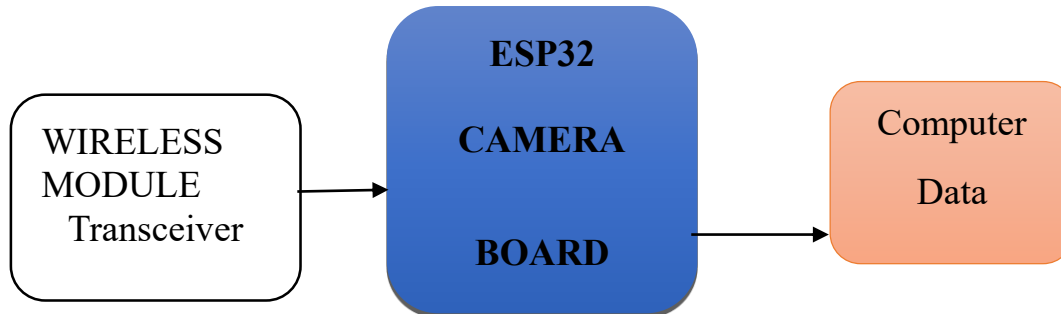
3. Proposed System

- *Automated Monitoring:* The system uses sensors to monitor environmental conditions, such as temperature, humidity, and toxic gases, and the animal's vital signs, such as heart rate. This data is stored in the Arduino board and can be accessed remotely, enabling caretakers to quickly detect and respond to any problems.

- *Automated Cleaning*: The system includes a motor that can be programmed to automatically clean the animal's living space, such as a litter box or cage, reducing the workload of caretakers and ensuring that the animal's living conditions are consistently clean.

- *Automated Feeding:* The system includes a motor that can be programmed to dispense food at specific intervals, ensuring that the animal is fed on a regular schedule and reducing the workload of caretakers.

- *Wireless Communication:* The Arduino board is connected to an ESP32 module for wireless communication, enabling data to be accessed remotely and reducing the need for caretakers to be physically present at all times.

4. Block Diagram

Figure.1. Block Diagram

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┌──────────────┐        ┌──────────────┐        ┌──────────────┐
│  WIRELESS    │        │    ESP32     │        │  Computer    │
│  MODULE      │───────▶│    CAMERA    │───────▶│              │
│  Transceiver │        │    BOARD     │        │  Data        │
└──────────────┘        └──────────────┘        └──────────────┘
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Figure.2. ESP32 Camera Section

5. Disadvantages of Existing System

• *Limited automation:* The existing animal care and management systems in zoos have limited automation, which means that most of the tasks are still performed manually by caretakers. This increases the workload of caretakers and makes it difficult to provide consistent care for animals.

• *Lack of real-time monitoring:* The existing systems lack real-time monitoring capabilities, which means that caretakers have limited visibility into the animals' behavior and health. This can lead to delays in detecting and responding to any potential problems, putting the animals' health and welfare at risk

• *Inefficient data management*: The existing systems rely on manual data entry and management, which can be time-consuming and error-prone. This makes it difficult to maintain accurate and up-to-date records of animals' health and welfare, which can hinder effective decision-making by caretakers.

- *Limited scalability:* The existing animal care and management systems in zoos are often designed for specific types of animals and enclosures, making it challenging to scale the systems for larger zoos or different animal species. This limit thesystems' usefulness and effectiveness in a variety of zoo settings.

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6. Advantages of Proposed System

- *Automation of caretaking tasks:* The proposed system automates various aspects of animal care, such as feeding and cleaning, reducing the workload and stress on animal caretakers.

- *Real-time monitoring of animal health and behavior:* The system uses sensors to collect data on environmental conditions and animal vital signs, allowing caretakers to quickly detect and respond to any potential issues.

- *Remote monitoring and control:* The data collected by the system can be accessed remotely, allowing caretakers to monitor animal welfare from anywhere.
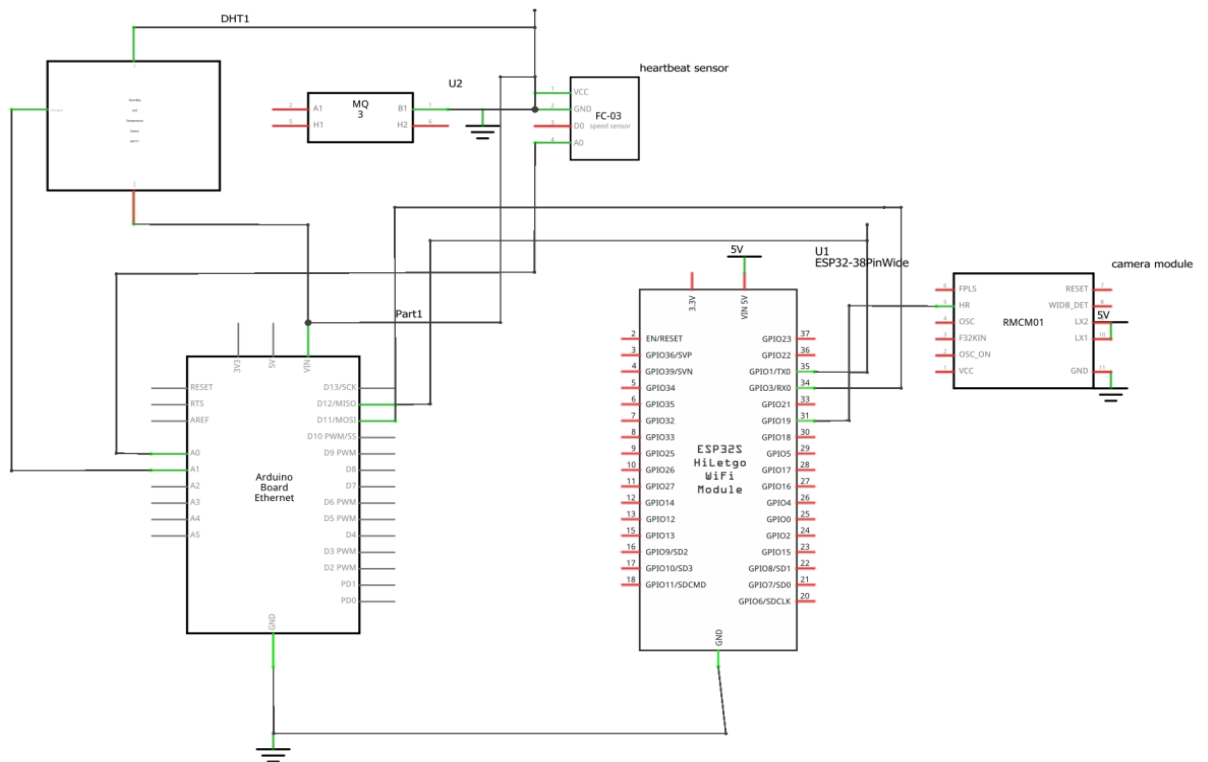
7. Circuit Diagram

Figure.3. Circuit Diagram

8. Methodology

- The circuit is powered by a 9V battery, which provides power to the Arduino board, sensors, and motors. The gas sensor, temperature and humidity sensor, and heartbeat sensor are connected to the Arduino board through their respective pins. The camera is also connected to the board using a separate port.

- The gas sensor is used to detect any toxic gases in the animal's environment, which could be harmful to its health. The sensor is connected to the board through the analog pin, and the data collected is sent to the board for processing.

- The temperature and humidity sensor is used to monitor the environment in which the animal is living. The sensor is connected to the board through the digital pins, and the data collected is sent to the board for processing.

- The heartbeat sensor is used to monitor the animal's vital signs, providing information about its health and any potential issues. The sensor is connected to the board through the analog pin, and the data collected is sent to the board for processing

- The camera is used for visual monitoring, allowing the animal's behavior to be observed remotely. The camera is connected to the board using a separate port, and the data collected is stored on the board for later viewing.

- The two motors, one for cleaning and the other for feeding, are connected to the board through separate digital pins. The cleaning motor can be programmed to automatically clean the animal's living space, such as a litter box or cage, while the feeding motor can be programmed to dispense food at specific intervals, ensuring that the animal is fed on a regular schedule.

- All data collected by the sensors and camera is stored in the Arduino board. The board is connected to an ESP32 module for wireless communication, allowing the data to be accessed remotely. The data can be used to monitor the animal's health and behavior, and to make adjustments to the system as needed.

- Overall, the animal care and management system based on the Internet of Things (IoT) provides a reliable and efficient way to monitor the environment, health, and wellbeing of animals in zoos. By automating various aspects of animal care, this system can improve the welfare of animals while reducing the workload and stress on animal caretakers.

9. Hardware Requirement

- *Arduino Board:* The Arduino board is a microcontroller board that provides a platform for controlling the various components in the system. It is responsible for collecting data from sensors, processing the data, and controlling the motors.

- *Sensors:* The system uses various sensors to monitor the animal's environment and health. These include:

- *Gas Sensor:* The gas sensor is used to detect any toxic gases, such as ammonia or carbon

  monoxide, which could be harmful to the animal's health.

- *Temperature and Humidity Sensor*: The temperature and humidity sensor is used to monitor the environmental conditions in which the animal is living. This sensor provides data on the temperature and humidity levels in the enclosure, which can have a significant impact on the animal's well-being.

- *Heartbeat Sensor:* The heartbeat sensor is used to monitor the animal's vital signs, providing information about its health and any potential issues.

- *Camera:* The camera is used for visual monitoring, allowing the animal's behavior to be observed remotely

- *Motors:* The system uses two motors, a water pump and a feeding motor.

- *Water Pump:* The water pump is used for cleaning the animal's living space, such as a litter box or cage.

- *Feeding Motor*: The feeding motor is used to dispense food at specific intervals, ensuring that the animal is fed on a regular schedule.

- *ESP32 Module*: The ESP32 module is used for wireless communication between the system and the user interface. This module enables the user to remotely access data collected by the sensors and control the motors.

- *Power Supply:* The system requires a power supply to operate. This can be either a battery or an external power source.

- *User Interface:* The user interface is a software application that enables the user to remotely access data collected by the sensors and control the motors. The user interface can be accessed on a computer or a mobile device.

10. Arduino Software(IDE):

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them

11. Embedded C

Embedded c is used for the control of the ESP32camera section and the WIFI module

12. Conclusion

The proposed intelligent animal care and management system based on the Internet of Things (IoT) is a promising solution for improving animal welfare in zoos. With the use of various sensors and an Arduino board, the system can automate many of the caretaking tasks while providing real-time data on animal behavior, health, and environmental conditions.

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