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INNOVATIVE TECHNOLOGIES IN LIVESTOCK FARMING: THE APPLICATION OF IOT (INTERNET OF THINGS)

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Annotatsiya

This article discusses the application of IoT (Internet of Things) technology, which is considered one of the innovative technologies in the livestock sector. The use of IoT technologies is important for monitoring the health of livestock, increasing their productivity, and preventing various diseases. The article highlights the possibilities of monitoring the condition of animals using intelligent sensor devices and the effectiveness of these technologies in animal husbandry.

Keywords

IoT technology, livestock farming, precision livestock farming, smart monitoring, animal health, sensors, automation, disease detection.

Introduction

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In recent years, livestock farming has been changing rapidly because farms are getting larger, labor is becoming more expensive and harder to find, and the market expects both higher productivity and better animal welfare. In such conditions, relying only on traditional visual observation is often not enough, especially when a single worker may be responsible for dozens or hundreds of animals. This is why the concept of Precision Livestock Farming (PLF) has become so important, as it focuses on monitoring individual animals in real time by using sensors, connected devices, and data analytics to support faster and more accurate management decisions. Researchers working on dairy systems emphasize that herd expansion makes it difficult to monitor individual animals consistently, which can negatively affect animal welfare, health, and performance. IoT, which refers to devices and sensors connected through cloud platforms, has been presented as a practical way to overcome these limitations.

Research Objective

The main objective of this study is to examine the application of IoT (Internet of Things) technologies in livestock farming and evaluate their role in improving animal health monitoring, disease prevention, productivity enhancement, and overall farm management efficiency.

Object of research: The system of application of IoT technologies in smart livestock farms was studied as the object of research.

Main Part

From a technical point of view, IoT in livestock farming usually involves a chain of processes that starts with data collection from animals or their surrounding environment, followed by wireless data transmission, storage, and processing through cloud-based systems. The final stage involves generating actionable outputs for farmers, such as alerts, dashboards, or automated control actions. One of the most significant benefits of IoT systems is the early detection of diseases. By identifying the initial signs of illness, heat stress, lameness, mastitis risk, or reproductive events earlier than manual observation, farmers can take timely preventive measures to reduce both economic losses and animal suffering. IoT-based livestock monitoring systems often include wearable hardware attached to animals, local infrastructure such as hubs or wireless routers, cloud servers for data storage, and user-friendly applications for farmers. These systems enable continuous monitoring of important welfare indicators such as animal activity levels, feeding behavior, and reproductive cycles.

A key aspect of IoT-based livestock management is determining which

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parameters should be measured. Modern PLF research indicates that common sensing approaches include inertial sensors such as accelerometers, image and video monitoring systems, and physiological indicators related to animal production and health. Wearable devices are particularly useful as they allow continuous monitoring of animals' physical conditions. Continuous behavior monitoring supports various practical applications such as health assessment, estrus detection, parturition monitoring, and feed intake estimation. In cattle farming, accelerometers are commonly used to detect activity patterns such as resting, walking, feeding, and rumination. Temperature sensors are widely applied because changes in body temperature can indicate disease, stress, or infection. These temperature variations may also be associated with reproductive processes such as estrus or calving. Additionally, GPS-based tracking systems are valuable in extensive grazing systems where monitoring animal location and movement is essential for herd management. Connectivity and system reliability represent another important aspect of IoT implementation in livestock farming. Farms often operate in remote areas where internet coverage may be limited and power supply inconsistent. Therefore, Low-Power Wide Area Networks (LPWAN), such as LoRaWAN, are frequently used for long-range communication in livestock monitoring systems. These networks enable the transmission of real-time data from wearable devices equipped with GPS receivers and inertial sensors to cloud platforms for further analysis.

Automated feeding systems

Once the collected data is processed, farmers receive meaningful insights rather than raw sensor readings. For example, IoT systems may indicate abnormal behavior, reduced movement, irregular rumination, or elevated body temperature, which may signal potential health problems. Early detection of such abnormalities allows timely veterinary intervention and prevents the spread of disease within the herd. Furthermore, IoT technology supports automation in livestock farming. Environmental sensors measuring temperature, humidity, and air quality can be connected to ventilation or cooling systems to maintain optimal living conditions.

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Automated feeding systems also improve feed efficiency and reduce waste, contributing to improved animal productivity. Despite these advantages, several challenges remain in the implementation of IoT technologies in livestock farming. These include high initial investment costs, potential data inaccuracies due to sensor malfunction, and the need for reliable connectivity. In addition, concerns related to data privacy, cybersecurity, and system maintenance must be addressed to ensure long-term sustainability.

IoT Sensors Used in Livestock Monitoring Systems *Table 1*

Sensor Type	Measured Parameter	Application Area
Temperature Sensor	**Body temperature**	**Disease detection**
Accelerometer	**Movement activity**	**Behavior monitoring**
GPS Tracker	**Animal location**	**Grazing management**
Humidity Sensor	**Environmental humidity**	**Climate control in barns**
Heart Rate Sensor	**Heart rate**	**Health monitoring**

Conclusion

In conclusion, the application of IoT technologies in livestock farming represents a significant step toward modernizing agricultural practices. IoT-based systems enable real-time monitoring of animal health, early disease detection, and improved farm management through automated decision-making processes. These innovations contribute to increased productivity, reduced operational costs, and enhanced animal welfare. However, successful implementation requires careful consideration of technological reliability, economic feasibility, and data security issues to ensure sustainable livestock production in the future.

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