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IoT-Based Animal Health Monitoring and Appointment System

Maruf Mujawar[1],Aseeruddin Mulla[2],Navedahmed Shaikh[3]

Department of Electronics and communication Engineering,
S.G. Balekundri Institute of Technology, Belagavi, Karnataka Visvesvaraya Technological University, Belagavi

ABSTRACT :

The proposed IoT-Based Animal Health Monitoring and Appointment System integrates ESP32, Arduino, GSM, and GPS technology to enable non-stop, actual-time monitoring of animal health parameters such as body temperature, coronary heart price, SpO_2 stages, and activity styles. The system autonomously detects anomalies inside the monitored information and sends immediately alerts via SMS to animal proprietors and emails to veterinary experts, followed with the aid of the animal stay GPS region. By automating health surveillance, the device reduces dependence on guide remark, promotes early analysis, and improves animal welfare, especially in livestock management, puppy care, and wildlife conservation. The machine is designed to be cost-effective, scalable, and power-green, making it suitable for huge-scale deployments in numerous environmental conditions. Future enhancements encompass the combination of AI-pushed predictive diagnostics, blockchain-primarily based stable health document management, and device gaining knowledge of algorithms to improve the prediction accuracy of animal illnesses and fitness developments.

Keywords: IoT, ESP32, Animal Health Monitoring, GSM, GPS, Veterinary Healthcare, Real-Time Tracking, Livestock Management, Smart Farming

INTRODUCTION

The health and welfare of animals, whether in agricultural settings or associate pets, are important not simplest for the proper-being of the animals themselves, however also for the monetary balance and productiveness of industries reliant on animal husbandry and veterinary care. In agriculture, the well-timed tracking of livestock health can drastically reduce losses and improve productivity. Similarly, in puppy care, early detection of health problems ensures a better neck of existence and decreases pricey emergency remedies. However, conventional techniques of animal health monitoring, which often rely upon periodic guide assessments, may be slow, inefficient, and vulnerable to human errors, in the end main to behind schedule diagnoses, increased risks of ailment, and reduced operational performance.

The upward push of the Internet of Things (IoT) has introduced a promising solution to those demanding situations. IoT enables the non-stop, real-time tracking of animal fitness through a community of interconnected sensors, that could tune critical fitness parameters along with body temperature, coronary heart fee, interest degrees, and respiratory. This gadget provides a far greater efficient method than conventional methods, making an allowance for the early detection of health abnormalities and permitting immediately intervention. By transmitting information to a cloud-primarily based platform, the device gives faraway monitoring, lowering the need for steady bodily presence and offering caregivers with immediate access to animal health information.

LITERATURE REVIEW

Several research have centered on cattle tracking the usage of simple sensors and mobile packages. Traditional solutions often rely closely on periodic guide assessments, which might be inefficient and liable to oversight. Recent advances consist of RFID-primarily based animal monitoring and cellular app-primarily based fitness tracking. However, many present systems lack actual-time alert mechanisms, integration with expert veterinary services, or the capability to remotely monitor fitness metrics. Unlike advanced systems, this proposed model combines actual-time statistics acquisition, GSM/GPS-primarily based communication, and cloud-primarily based file control to provide a whole, give up-to-cease animal healthcare answer. Moreover, the usage of ESP32 and Arduino microcontrollers ensures low electricity consumption and dependable overall performance, even in far off regions with constrained infrastructure.

METHODOLOGY

The machine operates through a non-stop loop where the sensors screen crucial animal parameters in actual time. Data is gathered and processed through ESP32/Arduino. Upon detecting values that fall out of doors the predefined normal range (e.g., fever, hypoxia, bizarre state of no activity), the gadget triggers an alert mechanism. An SMS alert with stay GPS coordinates is dispatched to the animal owner, and an electronic mail is dispatched to the veterinarian for similar action. If no abnormalities are detected, the machine resumes continuous monitoring. Data logging ensures that health styles

over the years may be studied to provide preventive healthcare measures. The modular layout also supports extra sensors like blood stress, ECG, or maybe environmental parameters like humidity and temperature around the animal.

4. Hardware and Software Components:

- • ESP32 Microcontroller: A powerful, Wi-Fi-enabled microcontroller appropriate for IoT programs.
- Arduino Uno: An extensively used microcontroller board based totally at the ATmega328P.
- GSM Module (SIM800L): Used for sending SMS indicators to users and owners.
- GPS Module (NEO-6M): Provides actual-time place tracking of the animal.
- Temperature Sensor (LM35 or DHT11): Measures the animal's frame temperature.
- Heart Rate and SpO_2 Sensor (MAX30100): Monitors the animal's coronary heart rate and oxygen saturation tiers.
- Motion Sensor (MPU6050 or PIR Sensor): Detects the motion or immobility of the animal, which can suggest health problems.

Software Tools:

- Arduino IDE for programming
- Platform IO for firmware improvement
- Firebase or other cloud platforms for database control
- SMTP libraries for e-mail functionality

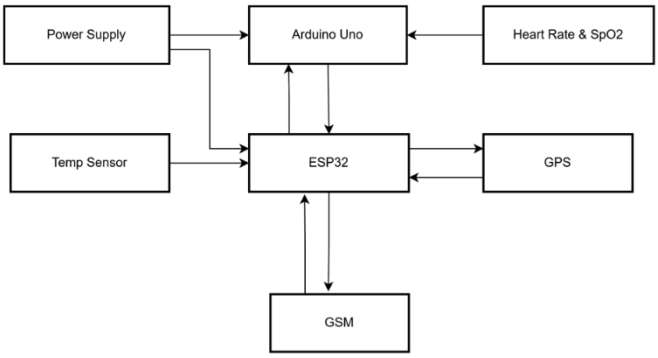

Fig: Block Diagram

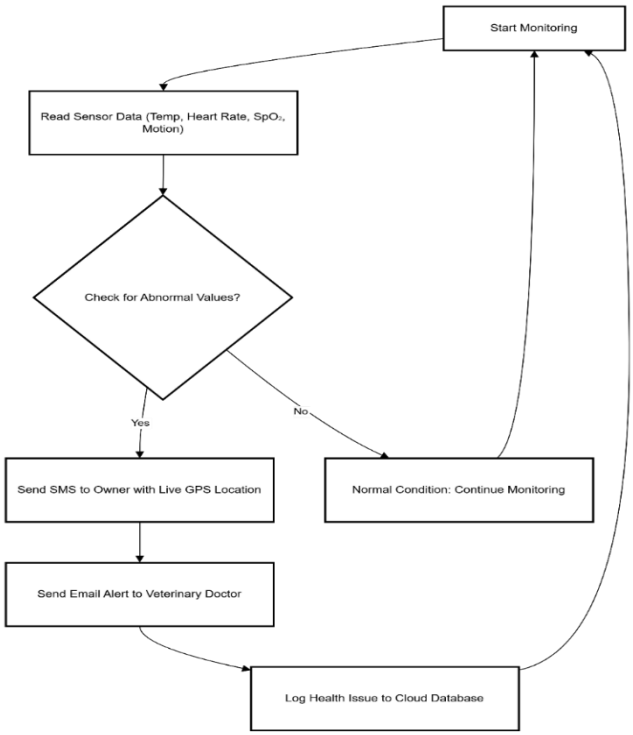

Figure : Flow Chart

The flowchart outlines a system that combines continuous health monitoring (through temperature, heart rate, SpO_2, and motion sensors), alert mechanisms (via SMS and Email), location tracking (through GPS), and cloud data management (using a database). Below is a step-by-step breakdown of the flowchart, explaining the interaction between each component and how they work together in the system.

1. Start Monitoring

- The system initializes the monitoring process.
- All connected sensors (temperature, heart rate, SpO_2, and motion sensors) are activated and prepared to collect data from the animal in real time.
- The system enters a continuous monitoring loop to ensure 24/7 observation of the animal's vital parameters.

2. Read Sensor Data (Temperature, Heart Rate, SpO_2, Motion)

- The system collects real-time data from the following sensors:
  - **Temperature Sensor**: Measures the animal's body temperature.
  - **Heart Rate Sensor**: Captures the heart beats per minute.
  - **SpO_2 Sensor**: Measures the blood oxygen saturation levels.
  - **Motion Sensor**: Detects movement and activity levels.
- All sensor readings are gathered and sent to the central processing unit (e.g., microcontroller or Raspberry Pi) for analysis.

3. Check for Abnormal Values

- After collecting the data, the system checks if any of the readings are outside the normal health ranges.
- Predefined threshold values for each parameter are used to detect abnormalities.
- Based on this comparison:
  - If any abnormal value is detected, the system proceeds to trigger an alert.
  - If all values are within normal range, the system continues monitoring.

4. If Abnormal Values Are Detected

a) Send SMS to Owner with Live GPS Location

- The system uses a GSM or mobile network module to send an immediate SMS alert to the registered animal owner.
- The SMS contains:
  - **Alert Message** describing the detected health issue.
  - **Live GPS Location** of the animal to help the owner quickly locate and attend to it.

b) Send Email Alert to Veterinary Doctor

- Simultaneously, the system sends an Email notification to the assigned veterinary doctor.
- The email includes:
  - Detailed sensor data (temperature, heart rate, SpO_2 levels).
  - Timestamp and GPS location for immediate response.
- This ensures that medical professionals are informed and can prepare for any necessary action.

c) Log Health Issue to Cloud Database

- All detected health issues, sensor readings, timestamps, and GPS locations are logged into a cloud database.
- This data serves as a historical record for:
  - Long-term health analysis.
  - Future reference by veterinarians.
  - System audits and improvements.
- After logging the data, the system returns to the monitoring loop and continues reading sensor values.

5. If No Abnormal Values Are Found

Normal Condition: Continue Monitoring

- If all sensor readings are within normal health ranges:
  - The system identifies that the animal is healthy.
  - No SMS, email, or database logging is triggered.
- The system simply continues the monitoring cycle, ensuring continuous protection without unnecessary alerts.

6. Looping Process

- The entire system operates in a continuous cycle.
- It regularly collects sensor data, checks for abnormalities, and acts accordingly without requiring manual intervention.

RESULT

A prototype became developed and examined on domesticated animals underneath controlled conditions. The system demonstrated excessive reliability in detecting temperature and coronary heart fee anomalies. Alerts were correctly sent inside a few seconds of detecting an anomaly. The GPS monitoring functionality maintained accurate positioning with minimal glide, and the cloud logging proved useful in developing a historical profile for every animal. The system's energy consumption was optimized by way of implementing low-strength modes at the ESP32 at some stage in idle durations. The results recommend that deploying any such system on a larger scale ought to notably beautify the performance of animal fitness control, reduce mortality costs, and improve cattle productivity.

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