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Futuristic Animal Health Surveillance and Tracking System with IOT Integration

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Abstract

Background: The farmers need to track the animals such as cattle and sheep as well as their activity. The manual inspection and tracking are difficult and tedious since the cattle may not stay at fixed locations.
Objectives: Fencing is not a feasible option as it involves considerable cost and cannot assure the cattle or livestock to stay in the fields.
Methods: This project deals with the development with Smart belt for animal protection. The proposed smart belts are an IOT based belt which can be used for sheep and cattle.
Statistical Analysis: The belts consist of sensors to keep a track of animal activity. The GPS present on the belt will be used to track the animal location by the owner using IOT as well as set Geo-fencing Alerts using android application where in if the animal leaves the safe zone, the owner will get a SMS notification.
Findings: The belt consists of a camera mounted on the belt which will record the animal activity and store in the SD card.
Applications: The Proposed system also implements animal protection from fire and accidents by interfacing fire sensors and throwing an alert to owner if the animal is near to fire zone.
Improvements: The innovative belt flashing system is designed which will detect the proximity of vehicles approaching the animals and start the flasher to save the animals life and avoid accidents.

Keywords: Smart belt, IOT, Camera, GPS Tracking, accident, Geofence.

1. Introduction

Food is essential for everyone, and the significance of the agricultural industry is immense. Factors such as the rapidly growing global population, reduced farming areas due to industrialization, the migration of farmers to urban centers, and climate change are increasingly challenging the agricultural sector. A robust and advancing agricultural industry is crucial to sustain the global population. Until the 18th century, agriculture was the primary driver of the world economy. The onset of the first industrial revolution around 1760, marked by the invention of the steam engine, led to large-scale mechanization. This mechanization prompted many farmers to leave their farms for urban areas in search of better socioeconomic opportunities. The

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subsequent second and third industrial revolutions further accelerated this migration, leading to the increased abandonment of agricultural lands.

2. Literature Survey

The study presented by K., S. in 2022 discusses a Cloud IoT-based Livestock Monitoring System (LMS) which includes three key features: a wearable collar equipped with IoT sensors to monitor and record animal health parameters, a unique identifier (UID) for livestock identification, and the ability to display detailed information wirelessly through QR code scanning and processing.
The research by Y. P. Pratama (2020) describes a collar device for cattle that measures heart rate, body temperature, and movement. It also involves managing local servers by establishing a base station, and utilizing a web application to visualize and analyze the health conditions of the cattle.
Kumari (2018) proposed a system for continuous animal health monitoring by measuring critical parameters such as heart rate, rumination, and body temperature. This system utilizes a Raspberry Pi 3 as the core controller and employs a WIFI module for communication.
Shinde's work focuses on employing sensor technology for the automatic measurement of various health factors in cattle, including temperature, heartbeat, and movement. The sensors, such as the LM35 for temperature, a stethoscope for heartbeat, and an electronic accelerometer for movement, are mounted on the cattle's body.
Swain (2017) proposed a health monitoring system for cattle that utilizes Arduino to detect parameters such as heart rate, temperature, rumination, and body humidity. The system uses Arduino for interfacing and Xbee for wireless communication. Various sensors are employed: DHT11 for temperature and humidity, KG011 for heart rate, and a three-axis gyro-accelerometer for rumination detection.

3. Problem Statement

The proposed project deals with the development of smart belt for animal protection. The smart belt can be used for tracking of the animals as well as provide the safety system to save animals from accidents and also fire hazards. The proposed problem involves development of an IOT based system in the form of smart belts. The sensors such as fire and proximity sensors read the surrounding for fire and proximity of the vehicle and send digital data to the controller depending on the situation. The WIFI connectivity of the smart belt is used to provide input data to the android application to notify the farmers. The GPS is also interfaced to the control which provides data input in the form of the NMEA strings which will be parsed by the controller to determine the latitude and longitude. The latitude and longitude are used to calculate geofence alerts which will make sure the cattle stay in the field. The camera module is also interfaced which captures the video data and stores it on the SD card for the visual activity tracking of the animals. The flashing system is implemented in the belt which will check the proximity alert to solve the problems faced in tracking the animals at night and saving them from accidents based on digital input signals from the controller which will be used to drive the flasher. The entire system of smart belt is divided into different modules which give an idea of system design of the project.

4. Objective

1. Develop a smart belt for animal safety which can be used to track the activity of the animals.

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2. To interface the camera to the belt which can be used to capture the animal activity and store the video on the SD card.
3. Develop A geofencing based alert system in the belt which will alert the cattle owner if the cattle try to leave the safe zone marked by the farmer.
4. To implement a Danger sensing system in the belt which will sense fire and alert the cattle as well as owner of the animals.
5. To implement IOT based system which consists of an android application which can be used for remote monitoring of the animals as well as the body temperature of the animals.

5. Methodology

The figure below shows the illustrative diagram of the project. The project consists of development of smart belts for animal safety. As shown in the illustrative diagram, the smart animal belts are developed in the form of compact wearable devices. The GPS modem as shown will capture the GPS data and send it to the IOT backend. The sensor is placed inside the belt to monitor the body temperature of the animals. The Fire sensor and the Flashing system present will be used to prevent the animal from fire hazards and Road accidents at night. The Camera is also placed on the belt to track the visual activity.

The Smart Belt Module

The smart belt module consists of a belt for cattle and sheep which will be used to protect them from accidents, fire, theft and also track the health and activity status of the animals. The smart belt module consists of following submodules:

- The GPS tracking and geo-fencing module which will keep a track of live location of the animals. The GPS module will also perform geofencing check to see if the animal is in the safe zone marked by the owner, and if the animal leaves safe zone the SMS alert will be sent to the owner using GSM.
- The Fire Safety system module consists of fire sensor to detect if there is fire near animal and save the animal from fire hazards.
- The Accident and Vehicle proximity detection module to save the accidents of vehicles with animals. This module consists of development of a sensor-based system to detect the proximity of the vehicle and a light flasher in the belt to flash the lights when the vehicle is detected so that animal will be easily visible at night and accidents can be avoided.

The Android Application Module

The android application is designed and developed in this module which will be used by the owners to track as well as monitor the safety and health status of the animals. The Android app will also be used to send the Geofencing coordinates to the smart belt over IOT.

This section explains the architecture diagram of the project. Smart belt consists of a WIFI controller interfaced with different sensors. The ESP32 Controller Board is interfaced with the GPS modem to track the GPS location and also to perform geo-fence alerts. The Temperature sensor is interfaced to measure the body temperature of the animals. The Proximity sensor interfaced to controller reads the data regarding the vehicle proximity and alerts the vehicle driver using a light flashing system on animal belt to prevent accidents at night.

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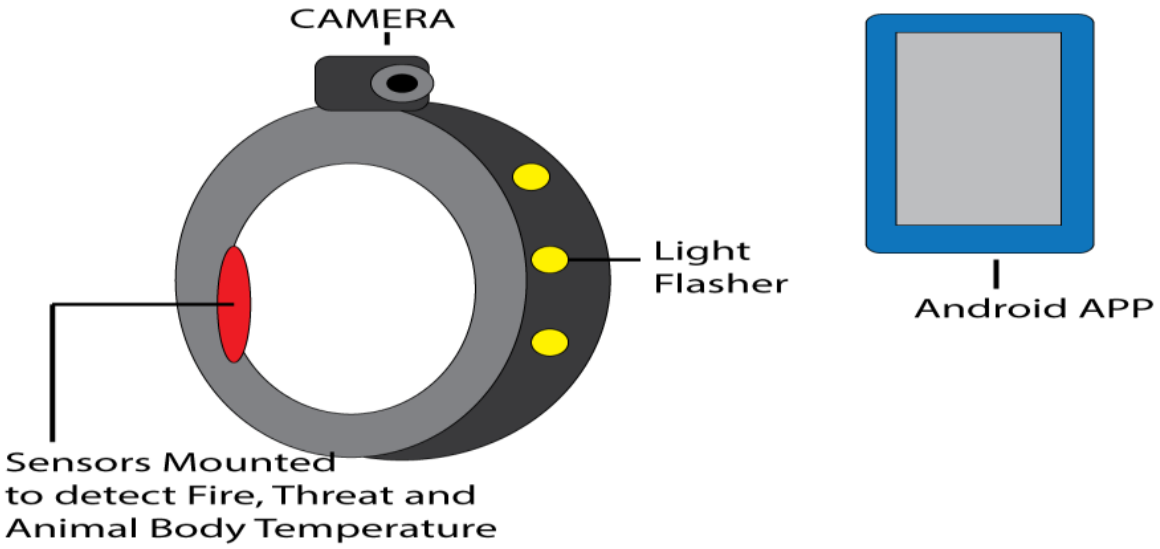

Figure 1. Overall System

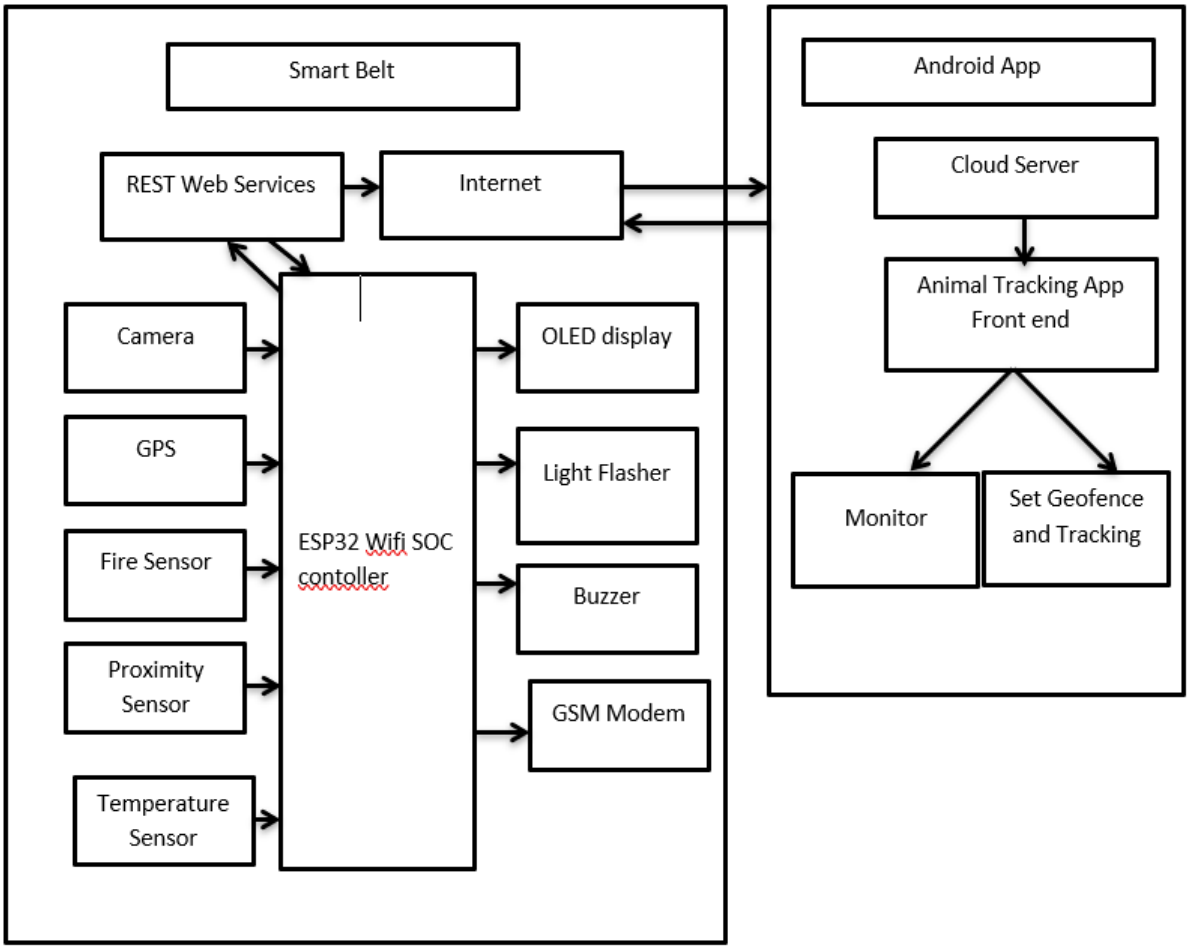

Figure 2. Functional Block Diagram

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6. Working

The futuristic Animal Health Surveillance and Tracking System with IoT Integration is a comprehensive network designed to monitor and manage the health and movements of animals using advanced technologies. At its core, this system utilizes IoT (Internet of Things) devices such as sensors, GPS trackers, and biometric monitors to collect real-time data on various aspects of animal health and behavior. These data points are then transmitted to a centralized platform where they are analyzed and interpreted to provide valuable insights into the overall well-being and status of the animal population. The system begins with the deployment of IoT devices on individual animals, which can range from livestock in agriculture to wildlife in natural habitats. These devices are equipped with a range of sensors capable of monitoring vital signs such as body temperature, heart rate, respiratory rate, and activity levels. Additionally, GPS trackers enable precise location tracking, allowing for the monitoring of movement patterns and habitat usage.

Figure 3. Prototype of the Project

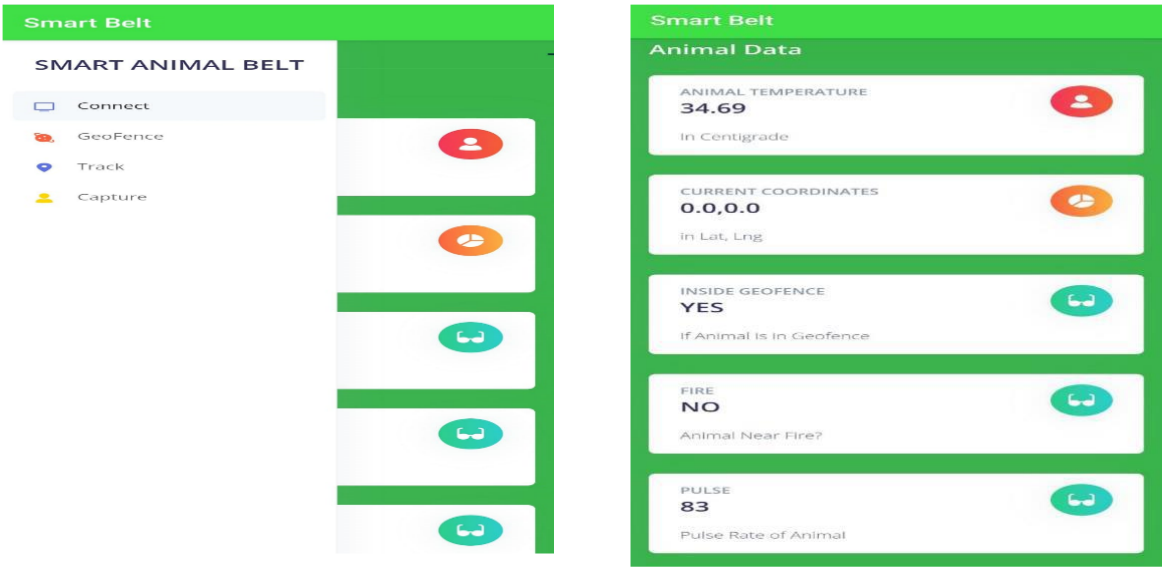

Figure 4. Android Application

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Once deployed, these IoT devices continuously collect data and transmit it to a central database or cloud-based platform via wireless communication protocols such as Wi-Fi, Bluetooth, or cellular networks. This real-time data transmission enables immediate access to critical information and facilitates rapid response to any emerging health issues or anomalies. In addition to physiological data, the Animal Health Surveillance and Tracking System also integrates environmental sensors to monitor factors such as temperature, humidity, air quality, and soil conditions. These environmental parameters play a crucial role in animal health and can help identify potential risk factors or environmental stressors that may impact animal well-being.

7. Conclusion

From the proposed project for the animal protection, we can conclude that the smart belt for animal protection will serve as a smart tracking system for animals which will track their location as well as the activity. The camera will help the farmers to track the activity by visualizing the video. The smart belts also help to save the animal from accidents and fire hazards and provide geofence notification to the farmers if animal leaves the safe areas. The proposed smart belt is expected to provide smart solution for cattle and sheep tracking and safety by using wearable's and IOT. The project is expected to:

- Keep a track of animal's health and notify the owners.
- Make sure the animal is in safe zone by using Geo-Fence and IOT.
- To provide a tool for tracking of the animals using IOT.
- To save the animals from night accidents by in belt light flashing system.
- To alert the owner in case of fire hazards.
- To monitor the Visual activity tracking using onboard cameras.

References

1. Agrawal, Himanshu, et al. "Smart feeding in farming through IoT in silos." The International Symposium on Intelligent Systems Technologies and Applications. Springer, Cham, 2016.
2. Anu, V. M., Deepika, M. I., & Gladance, L. M. (2015). Animal identification and data management using RFID technology. International Conference on Innovation Information in Computing Technologies.
3. Ezhilarasi, G.Dilip, T.P.Latchoumi, K.Balamurugan* (2020), UIP—A Smart Web Application to Manage Network Environments, Advances in Intelligent systems and computing book series, https://doi.org/10.1007/978-981-15-1480-7_8, 97-108.
4. Fakharulrazi, Alyani Nadhiya, and Fitri Yakub. "Control and Monitoring System for Livestock Feeding Time via Smartphone." Journal of Sustainable Natural Resources 1.2 (2020): 21-26.
5. Ilyas, Qazi Mudassar, and Muneer Ahmad. "Smart Farming: An Enhanced Pursuit of Sustainable Remote Livestock Tracking and Geofencing Using IoT and GPRS." Wireless Communications and Mobile Computing 2020 (2020).
6. Juan Ignacio Huircán, Carlos Muñoz, Héctor Young, Ludwig Von Dossow, Jaime Bustos, Gabriel Vivallo, Marcelo Toneatti,ZigBee-based wireless sensor network localization for cattle monitoring in grazing fields,Computers and Electronics in Agriculture,Volume 74, Issue 2,2010,Pages 258-264,ISSN0168699,https://doi.org/10.1016/j.compag.2010. 08.014.

7. K., S. and S., S. (2018), "Cloud IOT based novel livestock monitoring and identification system using UID", Sensor Review, Vol. 38 No. 1, pp. 21-33. https://doi.org/10.1108/SR-08-2017-0152.
8. Kumar, A., & Hancke, G. P. (2015). A Zigbee-Based Animal Health Monitoring System. IEEE Sensors Journal, 15(1), 610– 617.
9. Kumari, Seema and Yadav, Sumit Kumar, Development of IoT Based Smart Animal Health Monitoring System Using Raspberry Pi (2018). International Journal of Advanced Studies of Scientific Research, Volume 3 Issue 8, 2018, Available at SSRN: https://ssrn.com/abstract=3315327.
10. Latchoumi T. P, K. Balamurugan, K. Dinesh and T. P. Ezhilarasi, (2019). Particle swarm optimization approach for water-jet cavitation preening. Measurement, Elsevier, 141,184-189.