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AUTOMATION OF CATTLE LIVESTOCK

[1] Deepthi S Mouli,[2] Raghavendra R,[3] Sheethal B G [4] Nithin S K , [5]Dr S Pushpalatha

1,2,3,&4 Students, Department of Information Science and Engineering, Dr Ambedkar Institute of Technology, Bengaluru, Karnataka, India

5 Assistant Professor, Department of Information Science and Engineering, Dr Ambedkar Institute of Technology, Bengaluru, Karnataka, India

Abstract: Automation of Cattle Livestock is a groundbreaking initiative transforming cattle care and management, crucial for rural economies in India. The absence of accessible veterinary care, delayed vaccinations, and disease outbreaks significantly threaten cattle health and the livelihoods of dependent communities. This project offers a comprehensive solution using cutting-edge technology, including a robust cattle information management system with speech recognition for data input to accommodate diverse literacy levels. Its core feature is an intelligent vaccination scheduler that creates personalized vaccination plans based on individual cattle profiles and sends timely reminders to owners. Advanced image processing technology detects early signs of disease, enhancing preventive care. The project ensures accessibility through voice-enabled interaction, simplifies new cattle registration, and includes cattle tracking and shed cleaning. By improving cattle health, increasing accessibility, and promoting sustainable cattle rearing, Automation of Cattle Livestock aims to empower farmers, protect livestock, and drive rural community critical challenges with innovative solutions. Lumpy skin disease (LSD) is a severe and highly infectious pox disease in cattle caused by the lumpy skin disease virus (LSDV). To facilitate early control of LSD, a new rapid on-site detection method using image processing and IoT technology has been developed. This method aims to detect lumpy skin disease and monitor cattle health efficiently. In today's world, technology plays an indispensable role in enhancing our lives, and advancements like the Advanced Cattle Health Monitoring System using Arduino and IoT exemplify this progress. This system employs wireless sensors to continuously monitor critical parameters affecting cattle health, such as body temperature, respiration, heartbeat, and rumination. The framework utilizes an Arduino UNO microcontroller to sense these activities, and an ESP8266 Wi-Fi module serves as the transceiver.

I. Introduction

Livestock rearing, particularly cattle farming, is a crucial aspect of India's agrarian landscape, deeply embedded in the rural community's cultural and economic fabric. Cattle, revered as sacred animals, significantly contribute to agriculture, dairy production, and draught power. However, managing cattle in India faces numerous challenges that threaten their health and the livelihoods of those dependent on them. Key issues include limited access to veterinary care and delayed vaccination programs. In many rural areas, veterinary services are sparse, leaving cattle owners without essential resources to protect their animals' health. This leads to unchecked disease proliferation, severe livestock losses, reduced productivity, higher mortality rates, and potential zoonotic disease transmission to humans, posing significant public health risks.

Malnutrition further exacerbates these challenges, stemming from limited grazing resources and insufficient dietary supplementation. Poor nutrition undermines cattle health, leading to suboptimal reproductive outcomes and perpetuating economic hardship for farmers. Additionally, the lack of precise, data-driven management of cattle herds hampers effective decision-making regarding healthcare, breeding, and overall herd management. Inconsistent record-keeping and limited access to vital information hinder optimal cattle care.

The "Automation of Cattle Livestock" project aims to address these multifaceted challenges by integrating traditional cattle farming wisdom with cutting-edge technology and innovation. This initiative seeks to revolutionize cattle care, ensuring the well-being of these animals and securing the livelihoods of rural communities.

In parallel, the increasing number of pet owners has highlighted the need for continuous animal healthcare. Pet owners consider their pets as family members, making healthcare and medical treatment crucial. However, veterinarians and healthcare staff cannot provide round-the-clock care, and many hospitals lack a monitoring and alert system for tracking the condition of hospitalized animals. This shortfall often results in poor recovery and increased mortality rates.

To address this, researchers propose developing a web application focused on monitoring and recording the heart rate and temperature of sick animals, particularly dogs and cats. This application will play a vital role in health surveillance, providing real-time data to veterinarians and hospital staff. When abnormalities are detected, timely interventions can be made, potentially saving the animals' lives. The system aims to track and monitor symptoms in animals recovering from treatment or surgery, ensuring they receive the care they need during critical periods.

Additionally, Lumpy Skin Disease (LSD), caused by the LSD virus (LSDV) of the Capripoxvirus genus, poses a significant threat to cattle farming. LSDV is a double-stranded DNA virus causing severe skin lesions, reduced milk production, abortions, and secondary infections, primarily affecting beef and dairy farming in Africa and the Middle East. Recognizing and controlling this disease is crucial to protecting cattle health and productivity.

1.1 Existing System

1. **Cattle Management:** In the existing system, farmers manually locate their cattle, which is time-consuming and inefficient.
2. **Vaccination Management:** While the government notifies farmers about cattle vaccinations, farmers often forget to vaccinate their animals. This is a significant drawback of the current system.
3. **Disease Detection:** Diseases, such as lumpy skin disease, are often detected in later stages, leading to higher medical costs. Early detection is crucial for reducing these expenses and improving cattle health.

1.2 Proposed System

1. **Cattle Tracking:**
   Farmers input detailed cattle information such as breed, age, gender, health status, reproductive history, and milk production. Each cow is assigned a unique ID for efficient record-keeping.
2. **Health Monitoring and Disease Detection:**
   The system integrates computer vision and image recognition algorithms, allowing farmers to upload cattle images for disease diagnosis. AI-driven detection provides information and recommends actions, including contact details for local veterinarians.
3. **Vaccination Reminder:**
   The proposed system sends timely reminders to cattle owners to ensure vaccinations are administered on schedule.

II. Literature Survey

Key Studies on Lumpy Skin Disease (LSD) in Cattle Zeedan GSG, Mahmoud AH (2019)
Title: Detection of Lumpy Skin Disease Virus in Cattle Using Real-Time Polymerase Chain Reaction and Serological
Diagnostic Assays in Different Governorates in Egypt in 2017.
Journal: Veterinary World, 12(7): 1093-1100.

Summary: This research applied real-time PCR and serological diagnostic assays to detect the presence of LSDV cattle across various Egyptian governorates, demonstrating the effectiveness of these diagnostic tools in managing LSD outbreaks.

Abdi Feyisa (2018)

Title: Clinical Case Studies on Major Diseases of Veterinary Importance in Bishoftu Town, Ethiopia.

Thesis: Unpublished Master Thesis, College of Veterinary Medicine and Agriculture, Addis Ababa University.

Ahmed Ali (2018)

Title: Review on Lumpy Skin Disease and Its Economic Impacts in Ethiopia.

Journal: Journal of Dairy, Veterinary & Animal Research, Volume 7..

Betelihem Tegegne (2018)

Title: Outbreak Investigation of Lumpy Skin Disease; Isolation and Molecular Characterization of the Virus in South Wollo Zone, Northern Ethiopia.

Thesis: Unpublished Master Thesis, College of Veterinary Medicine and Agriculture, Addis Ababa University. Shubisa Abera (2017)

Title: Molecular Characterization of Lumpy Skin Disease Virus Isolates from Outbreak Cases in Cattle from Sawena District of Bale Zone, Oromia, Ethiopia.

Thesis: Unpublished Master Thesis, College of Veterinary Medicine and Agriculture, Addis Ababa University.

Summary: This thesis characterizes LSDV isolates from an outbreak in Bale zone, offering valuable genetic data that can inform targeted control measures and improve outbreak response strategies.

Teshome D, Derso S (2015).

Title: Prevalence of Major Skin Diseases in Ruminants and Its Associated Risk Factors at University of Gondar Veterinary Clinic, North West Ethiopia.

Journal: Journal of Veterinary Science & Technology, Special Issue S13-002.

DOI: 10.4172/2157-7579.1000S13-002.

Summary: This study examines the prevalence and risk factors associated with major skin diseases in ruminants, including LSD, at the University of Gondar Veterinary Clinic, providing essential epidemiological data for disease management.

Gezahegn Alemayehu and Samson Leta (2015)

Title: Incidence of Lumpy Skin Disease and Associated Risk Factors Among Export-Oriented Cattle Feedlots at Adama District, Central Ethiopia.

Journal: Journal of Veterinary Medicine and Animal Health, Vol. 7(4), pp. 128-134.

Summary: This paper discusses the incidence and risk factors of LSD in cattle feedlots aimed at export in Adama District, highlighting the importance of disease prevention measures to maintain cattle health and export quality.

EFSA AHAW Panel (2015)

Title: Scientific Opinion on Lumpy Skin Disease.

Journal: EFSA Journal 2015; 3986, 73 pages.

Summary: This comprehensive review by the EFSA Panel on Animal Health and Welfare covers the epidemiology, impact on animal health and welfare, and strategies for controlling LSD, providing a thorough scientific basis for policy recommendations.

E.M. El-Nahas and A.S. El-Habbaa (2011)

Title: Isolation and Identification of Lumpy Skin Disease Virus from Naturally Infected Buffaloes at Kaluobia, Egypt.

Journal: Global Veterinaria, Volume 7.

Summary: This study details the isolation and identification of LSDV from naturally infected buffaloes in Kaluobia, Egypt, contributing to the understanding of LSD's impact on different livestock species and informing cross-species disease management practices.

III. Theoretical Fundamentals

3.1 Convolutional Neural Network

Traditional CNN is used in computer vision and is very good at extracting feature information from images. A CNN is a deep learning technique that is particularly well-suited for the examination of visual data. The layers that make up a CNN are often categorized into 3: Convolutional Layers, Pooling Layers, and Fully Connected Layers. The CNN's complexity rises as data moves through these layers, enabling it to detect progressively more abstract characteristics and greater areas of a picture. Figure 1 represents the general CNN structure.

The convolution function is given as follows:

$$H_j^{l+1} = \sum_{i \in x_j} H_j^l * w_{ij}^{l+1} + b_j^{l+1} \tag{1}$$

where H_j^{l+1}denotes the jth feature map of the neuron at layer *l+1*, * denotes the convolution function, w_{ij}^{l+1}denotes the convolution kernel connecting the jth feature map of the neuron at layer l+1 and the ith feature map of the neuron at layer l, b_j^{l+1}denotes the bias, and $x_j$denotes the image of the input CNN.
There is a linear process in the convolution layer. A nonlinear activation function is introduced to the model to improve its classification performance. The Sigmoid function, Tanh function and ReLU function, which are frequently used are defined as follows:

$$f_{sigmoid}(x) = \frac{1}{1+e^{-x}} \tag{2}$$

$$f_{Tanh}(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} \tag{3}$$

$$f_{ReLU}(x) = \begin{cases} x, x \geq 0 \\ 0, x < 0 \end{cases} = \max(0, x) \tag{4}$$

Pooling layers take part in reducing the network parameters, and it is given as follows:

$$H_j^{l+1} = \mathrm{f}(\beta_j^{l+1}\, down\, (H_j^l) + b_j^{l+1}) \tag{5}$$

where down(.) denotes a subsampling function, β denotes the multiplicative bias.

The two most popular pooling techniques are average and maximal pooling. While average pooling averages the window values and outputs them, maximum pooling produces the window's maximum value. We employ the greatest pooling layer in this study. Figure 2 displays a schematic of the Maximum pooling technique. In the example, the step size is two and the convolution kernel is two by two in size.
The feature data that was previously extracted is classified using the fully connected layer; this process is represented as follows:

$$y^k = f(w^k x^{k-1} + b^k) \tag{6}$$

where *k* is the *k-th* layer network, $x^{k-1}$is the input of the *(k-1)-th* fully connected layer, the $y^k$is the output of the *k-th* fully connected layer, $w^k$is the weight coefficient, $b^k$is the bias, and *f* is the classification function.

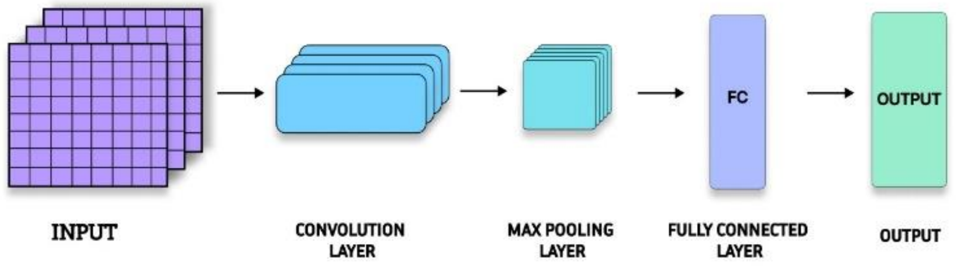

Figure 1 General CNN Structure

IV. METHODOLOGY

- **Data Collection**
  To address the study's objectives, a comprehensive image dataset was collected. A substantial number of images are necessary for both training and testing the model. For training, images were sourced from various veterinary clinics and the Internet. Specifically, 250 images of Lumpy Skin Disease (LSD) were collected from online sources and local livestock production offices in the Oromia region's Bale zone (Medawelabuwereda) and Arsi zone (Cholewereda). These images were captured using a digital camera under controlled conditions. For testing, images were acquired using a smartphone camera with an 18-megapixel resolution to ensure high-quality data for dataset preparation.

- **Dataset Preparation**
  The datasets were prepared using the collected images. Images from veterinary clinics and the Internet were categorized manually into healthy and infected groups, with infected images further divided into severe and mild cases. For model training, 80% of the dataset was utilized, while the remaining 20% was reserved for testing. This approach ensures that the model is both trained on a diverse set of images and rigorously tested to validate its accuracy and reliability.

- **Implementation Tools**
  Several open-source libraries and tools were employed to detect Animal Lumpy Skin Disease. The Anaconda environment and Python programming language were chosen for their scientific computing capabilities. Python was used for preprocessing, feature extraction, and classification due to its simplicity, readability, and extensive range of third-party libraries suited for deep learning. Key libraries included TensorFlow, Keras, OpenCV, and Matplotlib.

- **TensorFlow:** Used for scientific computing tasks, particularly neural networks.
  Keras: Built on top of TensorFlow, Keras is user-friendly, supports modularity, and is easily extensible.
  OpenCV and Matplotlib: Utilized for image processing and visualization.
  The experiments were conducted using Jupyter Notebook on a computer equipped with an Intel(R) Core(TM) i5-10210U CPU @ 1.60GHz, 2112 MHz, with 4 cores and 8 logical processors. This setup provided the necessary computational power and flexibility to perform extensive image analysis and model training.

V. CONCLUSION AND FUTURE WORK

The main challenge observed in this study is the non-existence of Lumpy skin disease Image data sate for experiment and Noises for properly detecting the region of interest. This study achieves notable results in detecting lumpy skin disease, successfully classifying it into severe, mild, and normal categories. One of the key contributions of this research is the preparation of a comprehensive lumpy skin disease image dataset, which serves as a foundational resource for further studies. Additionally, the study involves the construction of a robust image classification model specifically tailored for lumpy skin disease. This model leverages advanced algorithms to accurately identify and categorize the disease stages. Another significant contribution is the development of a method that utilizes local information to understand the incidence and spread of animal epidemic diseases. This approach provides valuable insights into disease patterns, aiding in timely interventions and control measures.

However, the study faced significant challenges. The primary issue was the non-existence of a pre-existing image dataset for lumpy skin disease, which posed difficulties in conducting experiments. This gap necessitated the creation of a new dataset, which required considerable effort and resources. Additionally, the presence of noise in the data made it challenging to accurately detect the region of interest within the images. Noise can obscure critical features necessary for precise classification, thus complicating the detection process. Overcoming these challenges involved implementing noise reduction techniques and refining the image processing algorithms to enhance accuracy.

Despite these obstacles, the study's findings represent a significant advancement in the field of veterinary diagnostics. By providing a structured dataset and a reliable classification model, the research lays the groundwork for more effective monitoring and management of lumpy skin disease. Future research can build on these contributions, further refining the techniques and expanding the dataset to include more diverse and representative samples. This progress ultimately aims to improve animal health outcomes and mitigate the impact of lumpy skin disease on livestock populations.

REFERENCES

[1]. Zeedan GSG, Mahmoud AH, (2019), "Detection of lumpy skin disease virus in cattle using real-time polymerase chain reaction and serological diagnostic assays in different governorates in Egypt in 2017", Veterinary World, 12(7): 1093-1100.

[2]. Abdi Feyisa, (2018), "clinical case studies on major diseases of veterinary importance in bishoftu town, Ethiopia", unpublished Master Thesis, College Of Veterinary Medicine And Agriculture Department Of Clinical Studies Addis Ababa university

[3]. Ahmed Ali, (2018), "Review on lumpy skin disease and its economic impacts in Ethiopia", Journal of Dairy, Veterinary & Animal Research, Volume 7

[4]. BetelihemTegegne,(2018), "Outbreak investigation of lumpy skin disease; isolation and molecular characterization of the virus in south wollo zone, northern Ethiopia", unpublished master thesis, college of veterinary medicine and agriculture, Addis Ababa university

[5]. ShubisaAbera, (2017), "molecular characterization of lumpy skin disease virus isolates from outbreak cases in cattle from sawena district of bale zone, Oromia, Ethiopia", unpublished master thesis, college of veterinary medicine and agriculture, department of microbiology, immunology and veterinary public health, Addis Ababa university.

[6]. Teshome D, Derso S,(2015), "Prevalence of Major Skin Diseases in Ruminants and its Associated Risk Factors at University of Gondar Veterinary Clinic, North West Ethiopia". J VeterinarSciTechnol S: S13-002. Doi:10.4172/2157-7579.1000S13-002

[7]. GezahegnAlemayehu and Samson Leta, (2015), "Incidence of lumpy skin disease and associated risk factors among export-oriented cattle feedlots at Adama District, Central Ethiopia", Journal of Veterinary Medicine and Animal Health, Vol. 7(4), pp. 128-134

[8]. EFSA AHAW panel (EFSA Panel on Animal Health and Welfare), (2015), "Scientific Opinion on lumpy skin disease", EFSA Journal 2015; 3986, 73pp.

[9]. E.M. El-Nahas and A.S. El-Habbaa, (2011),"Isolation and Identification of Lumpy Skin Disease Virus from Naturally Infected Buffaloes at Kaluobia, Egypt", Global Veterinaria 7.