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# INTELLI COOP: ADVANCED MONITORING SYSTEM FOR PRECISION POULTRY FARMING

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**Abstract**
The chicken poultry industry is one of the most important industries for the supply of sustainable food in our country. This paper represents an extensive perspective for automating and enhancing management in poultry farms through the integration of four distant technologies: early disease detection, flame detection with SMS alert, chicken population counting and animal monitoring. For disease management, we propose an early detection system utilizing Convolutional Neural Networks (CNN) to analyse the hen droppings and identify the potential disease outbreaks at an early stage, minimizing the risk of epidemics. The flame detection system is designed for the quick identification of fire hazards using sensor – based detection methods, prohibiting farm – wide fires and reducing animal loss. And an automated counting system that tracks the population of chickens in real time, using the YOLO model assuring accurate inventory management. Additionally, a Passive Infrared (PIR) sensor is employed to monitor the animal presence around the farm, helps detecting unauthorized entries and ensuring the safety of farm workers and animals.

***Keywords** – Fire, theft, disease, CNN, PIR sensor, counting, YOLO model.*

## I. INTRODUCTION

Poultry farming is a form of animal husbandry which raises domesticated birds such as chickens, ducks, turkeys and gees for the production of meat or egg for food. More than 60 billion chickens are killed for consumption annually. A chicken coop or hen house is structure where chickens or other fowl are kept safe and secure. There may be nest boxes and perches in the house. There is a long – standing controversy over the basic need for a chicken coop. Poultry is one of the emerging segments of livestock/agriculture sector and contributes a major share in terms of protein supplementation from eggs and meat. India is 3rd largest producer of eggs and 5th rank in meat production in the world. Chicken farming industry faces various challenges, especially those related to the health and welfare of chickens, which will affect the yield and quality of the production. To improve the production and maintain the health of chickens, information and communication technology has excellent potential to provide practical solutions. One technology that is attracting attention is CNN Technology. Convolutional Neural Network (CNN) is an artificial neural network that can accurately process ad recognize patterns in images or visual data. CNN is a type of deep learning model specifically designed for processing image data. CNNs outshine in recognizing patterns, textures and features, making them highly effective for image – based disease detection. The model will be trained using a dataset of poultry images, categorized into healthy and diseased classes.

Fire incidents have always been a dangerous threat to property owners and every individual. Fire detection in poultry farm is crucial for ensuring the security of safe livestock. Fire outbreak is likely to occur anywhere, anytime. Fire sensors are considered as part of wireless sensor network plays a major role in monitoring and detecting the abnormal increase of temperature and humidity rate. In the case of fir outbreak the systems are integrated with the real – time alert mechanisms such as SMS, email, or mobile app notifications. This ensures that the farm owners and workers are immediately informed, enabling faster response and loss prevention. A DTH 11 sensor is used in this project to monitor the temperature and humidity rates in a specific location. In case of fire outbreak, the temperature will increase and the humidity will decrease. PIR sensors are electronic devices used to detect the motion by measuring infrared (IR) radiation changes in their field of view. PIR sensors can detect body heat and motion, making them useful for monitoring animal presence. PIR sensors are called “passive” because they do not emit energy for detection. Many PIR sensors have two slots made of pyroelectric material.

The YOLO (You Only Look Once) model is a real-time object detection algorithm that processes the entire image in a single step. Instead of scanning the image multiple times like traditional methods, YOLO divides the image into a grid and predicts bounding boxes and class probabilities for each grid cell simultaneously. This unified approach allows YOLO to detect multiple objects quickly and accurately, making it ideal for applications that require fast and efficient object detection, such as monitoring hens in a poultry farm.

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## II. LITERATURE SURVEY

Poultry farming is a popular choice among small – scale farmers. The farmers produce boilers, layers, village chicken and others such as quails, ducks, guinea fowls, emo and ostrich. The contribution from poultry industries has increased lot. There are over 1.1 million small and medium – scale poultry industries. Implementing an image separation system is a tough task that demands for many multifactor considerations, especially diverse interclass interactions. The results of this study shows that the highest recognition accuracies of CNN were 93.01%, 95.05% and 97.43% on the second, fourth and sixth day after injection with the H9N2 virus, respectively, which were much higher than the recognition accuracies of RNN (49.97%, 55.86% and 57.10%) respectively. A systematic review was conducted to assess the impact of diseases and other causes of mortality in backyard chickens from low and middle – income countries. Results from meta – analyses shown that three main causes of mortality in a production cycle are viral diseases (24.5%, 12.4 – 42.7), the mix of bacterial and viral diseases (24.2%, 6.2 – 58.2) and bacterial diseases (11.2%, 4.6 – 25.0). These three mortalities cause also account for the highest proportion of the economic losses for infectious diseases. The application of advanced technologies in poultry farming has seen significant progress over the past decade. In 2019, researchers began utilizing Convolutional Neural Networks (CNNs) to detect and classify poultry diseases at an early stage. These CNN-based solutions enabled real-time monitoring and diagnosis of infected birds, thus helping to prevent the rapid spread of diseases among chicks and minimizing mortality rates. The early detection systems significantly improved the health management practices in poultry farms.

The major concern faced by poultry farmers, especially in tropical regions, is the increased risk of fire outbreaks due to rising temperatures during summer. These fire incidents often result in critical damage and economic losses. To solve this, innovative solutions such as flame-detecting sensors were introduced by student researchers. These sensors are capable of identifying flames at an early stage and triggering alert mechanisms, thereby enhancing the fire safety measures in poultry facilities. Additionally, maintaining an accurate count of chicks or hens has traditionally been a labour-intensive and error-prone process. Recognizing the need for automation in population management, researchers explored computer vision-based techniques. The You Only Look Once (YOLO) object detection model emerged as a reliable solution for this task. By applying YOLO to real-time surveillance images, the system is able

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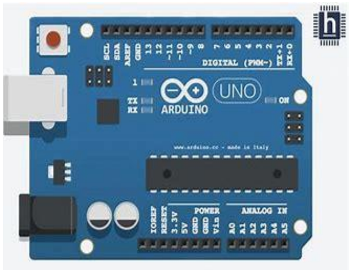
to detect and count individual hens with high accuracy, thereby aiding in effective livestock management. Recent advancements have combined these technologies into integrated systems that address disease detection, fire safety, and population tracking. These solutions collectively contribute to smarter and more resilient poultry farming practices, laying the groundwork for precision livestock farming.

## III. COMPONENTS USED

### 1. ARDUINO UNO



The Arduino Uno is a popular open – source microcontroller board based on the ATmega328P microchip. It was widely used for building interactive electronic projects and prototyping. Dual configuration on the Arduino board assures elasticity in terms of scalability and the robustness of the communication network. This plays a major role in conducting the project due to its versatility and ease of use. This board interfaces with a variety of sensors to gather data, which is essential for projects monitoring or automation. Helps in ensuring the precise control and data processing resulting and accurate outputs.

### 2. FLAME SENSOR

A flame sensor is an electronic device that detects the presence of a flame or fire. It is commonly used in safety systems to monitor for fire hazards and trigger alerts or activate fire suppression mechanisms. Flame sensors typically operate by detecting the infrared (IR) or ultraviolet (UV) light emitted by a flame. In poultry farm projects, flame sensors help in

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monitoring potential fire hazards and protect livestock by triggering alarms or initiating cooling systems.

**3. PIR SENSOR**

A PIR sensor is an electronic sensor used to detect motion by measuring changes in infrared radiation levels in its environment. It works based on the principle that all objects, including humans and principle that all objects, including humans and animals, emit infrared radiation in the form of heat waves. PIR sensors are commonly used in security systems to detect intruders. These sensors are commonly used in security and automation systems due to their simplicity and efficiency in detecting motion.

**4. GSM MODULE: SIM800L**


The SIM800L is a GPRS module designed for communication via cellular networks, used in embedded systems for SMS, voice and data transmission. It supports multiple frequency bands (850/900/1800/1900 MHz), making it suitable for global usage. The module can send/receive messages and establish voice calls. It operates at 3.4V to 4.4V, typically powered by a 4V supply. Requires a micro – SIM card for network communication.

**5. YOLO Model**

The YOLO (You Only Look Once) model is a real – time object detection system that identifies and classifies multiple objects in a single image Fastly and accurately. The YOLO model scan images in multiple passes, It treats object detection as a single regression problem, predicting bounding boxes and class probabilities directly from full images in one evaluation. This makes

YOLO extremely fast and suitable for real – time applications like video surveillance, object detections etc.

## IV. METHODOLOGY

Figure 1 below illustrates the overall system workflow of the proposed Intelli Coop framework. It integrates flame detection using Arduino, disease detection via a machine learning model, and hen counting with the YOLO model. All data is processed through a Django-based backend and visualized on a web dashboard for real-time monitoring and management.

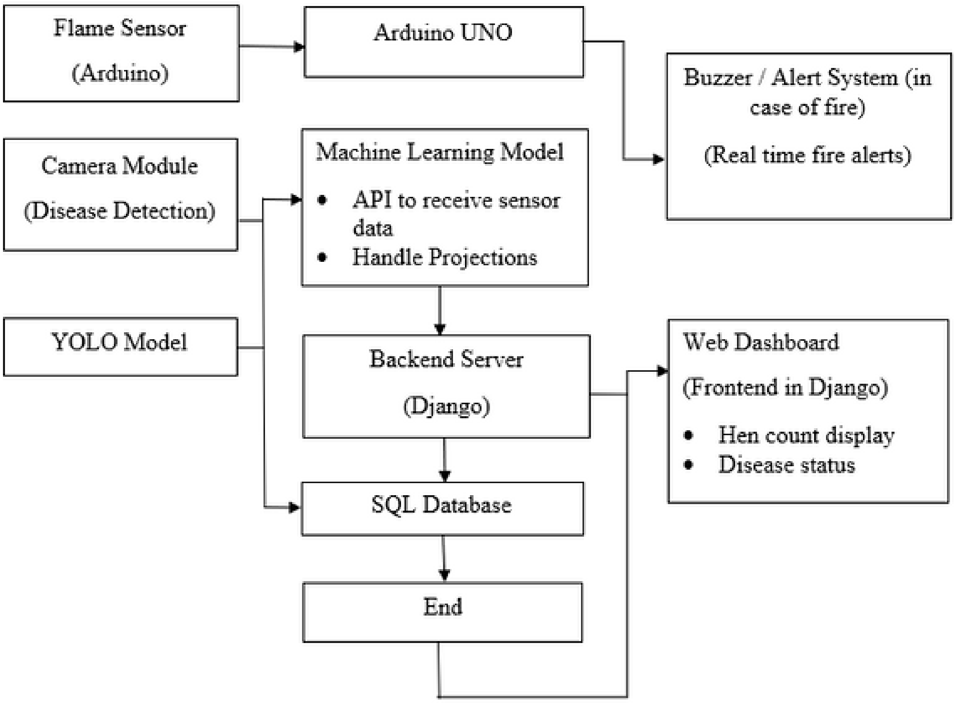


Fig 1: Workflow of the proposed paper

The device system process basically starts from detection of the basic sensor used by the researchers in development. Sensor includes: flame sensor, which detects the presence of flame in a room and is calibrated for effective detection; butane sensor, detects explosive and flammable gases and is used in this device to specifically detect the presence of butane gas in a certain reach of its range. Each sensor continuously provides real time detection data, which is transmitted to a base station. Before the data reaches the base station, the Arduino Uno R3 microcontroller processes and manages the data via serial communication. The base station, equipped with the microcontroller and an RF data receiver, captures and displace received data on a local host for monitoring purpose. Furthermore, data retrieval is enhanced by the

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integration of an Android mobile application, allowing for remote monitoring irrespective of distance. This functionality is made possible by incorporating a GSM module into the system, overcoming distance limitations and addressing potential internet connectivity issues. With a single press of button in the mobile app, user can receive real time feedback from the device, which is then displayed on the app interface. The system's alarm process is structured into two levels of detections, ensuring timely and efficient responses to potential hazards. We propose a model for monitoring both flame and intruder presence within a chicken house, as depicted in figure 2. The system's sensor nodes consist of a flame sensor, ultrasonic sensor, PIR sensor and a microcontroller. While the PIR and ultrasonic sensors detect the presence of intruders. When the temperature exceeds the predefined threshold or when an when an intruder is detected, the gate way alerts the farmer through SMS notification using the GSM shield.

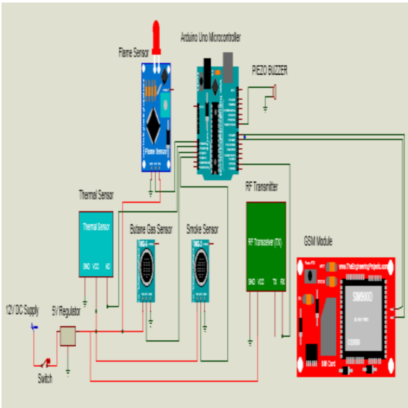


Fig 2: Schematic diagram of sensor node

The farmer can access the data via an android or web browser as depicted in figure 3, GSM enhances the system's reach, enabling data access over kilometres through SMS and GPRS, ensuring coverage in broader monitoring areas. Cloud storage facilitates long – term data retention and analysis, while mobile applications offer user – friendly interfaces for real time monitoring and value – added services beyond environmental tracking. Finally open – source microcontroller boards offer flexibility and cost – efficient in hardware and software design. This integrated approach addresses the agriculture challenges by enhancing monitoring capabilities and improving farm management efficiency.

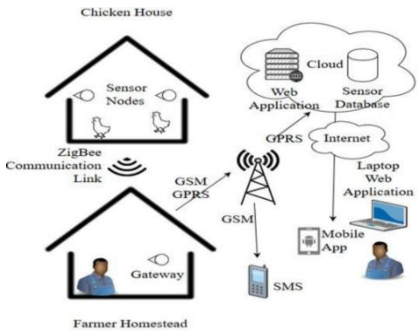


Fig 3: Cloud – based data analysis model

The most common and dangerous poultry disease, Coccidiosis causes substantial economic damage on a global scale. Coccidiosis is caused by bacteria present in chicken intestines, which are in turn caused by intracellular protozoa parasites of the Eimeria species. Th main contribution of the proposed work is an efficient and resilient framework that is designed using deep learning approach to classify four classes of poultry diseases Coccidiosis, healthy, salmonella, new castle disease. A few improved tactics have been used to match out the dataset across classes after the dataset have been divided into training, validation and tested using these images. On the test set, the model's performance achieved an accuracy of 94.57 percent. The defined methodology allows for automated diagnosis. It can validate the conclusions of medical experts and be handled by non – technical staff in basic healthcare facilities in remote areas for the early categorization of poultry diseases into four distinct categories. The built classification architecture is fast and accurate, making it an advanced and excellent choice for use in the medical field. Deep learning algorithms are used in classification of diseases. Few algorithms used are:

1. **Basic CNN model:** A crucial CNN architecture for image classification, involving convolutional pooling and fully connected layers to detect disease characteristics form the images.
2. **Transfer Learning models:** These models are fine – tuned with disease specific images, significantly refunctioning training time to maintain the high accuracy rate.
3. **Data augmentation:** So many techniques such as rotation, flipping, zooming and colour adjustments are followed to increase the diversity of the training dataset.
4. **Recurrent Neural Networks with CNNs:** used to capture sequential patterns related to disease progression.

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5. **Ensemble learning:** Combining multiple CNN models or algorithms to improve detection accuracy and robustness, alleviating the weakness of any single model.

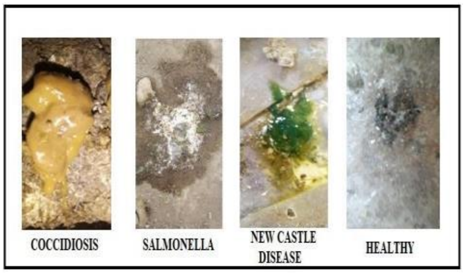


Fig 4: Different classes of diseases

Figure 4 depicts the classes of diseases that are caused to chicks. These images are reduced to proper dimensions in order to undergo training, validating and testing process.

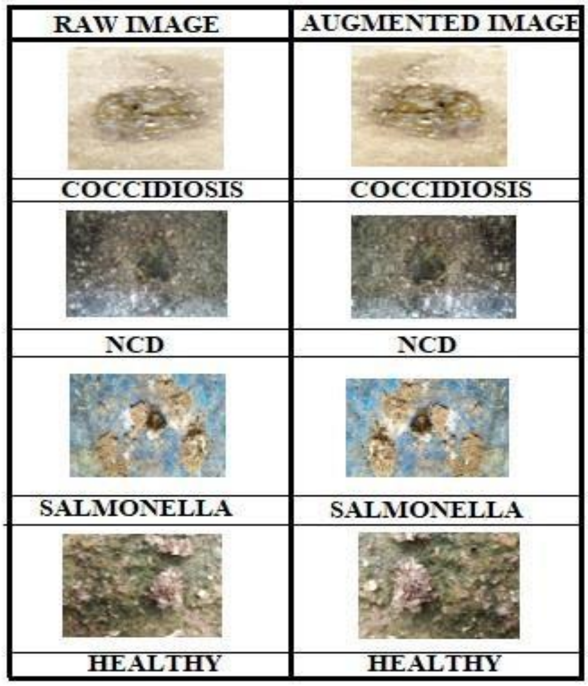


Fig 5: Dataset before and after augmentation

The above figure gives information that the images of diseases before and after augmentation. The set of images on the left shows the real images that are captured in a camera and the images on the right are the converted version of the images for the training, validating and testing methods. The augmentation process makes the prediction easier which produces the accurate and efficient results.

## V. CONCLUSION

The “Smart Monitoring System for Poultry Farming” aims to bring a profound effect on the poultry industry by resolving the pivotal needs for real – time monitoring and upgraded animal welfare. This system incorporates advanced technologies, such as image – based disease detection, flame detection, automated hen counting and PIR sensors for environmental monitoring. These cutting – edge solutions collectively affirm timely interventions, reducing losses and improving the farm productivity. By facilitating early disease diagnosis and automating response actions, this system reduces dependency on manual oversight, minimizes the spread of infectious diseases and assures safety. Furthermore, the system’s integration with SMS alert features ensures that farmers receive fundamental updates, allowing for prompt working. Overall, this system contributes to more viable and effective poultry farming practices, providing a prototype that can be adapted and scaled to meet the growing demands of the agriculture sector.

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