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IISPF:IOT Integrated Smart Poultry Farm Using k-NN Algorithm

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Abstract

Chicken farms have been crucial throughout human history in supplying nourishment for the growing population. A proper setting is key for fowl development, keeping illness at bay, and efficient yield. High temperature and moisture levels encourage bacterial multiplication, resulting in the creation of ammonia (NH3) by way of organic matter breakdown. Ammonia (NH3) and Nitrogen (CO2) are dangerous gases that may bring about fowl sickness and mortality. The joining of Machine Learning (ML) and the Internet of Things (IoT) delivers an effective real-time oversight arrangement. Via this integration of machine learning and the internet of things, chick disease can be foretold, and the provision of feed and water, together with warmth, can be made automatic. Dangerous gases such as ammonia and nitrogen are observed by sensors. When the amount of ammonia and nitrogen gas rises in the air, automated neutralizers start up to work against the detrimental gases. The setup is made to be a live automation monitor and to show fowl farm atmospheric states like warmth, feed level, water level, hot condition, and cool condition. For feeding, chicks utilize a tray with a linked ultrasonic sensor. If the chick feed level is under the marked spot, the ultrasonic sensor gives alerts to the chicks feed box, and feed is released into the tray. If the chick feed level is over the marked spot, the ultrasonic sensor signals the chicks feed box, and the feed distributing ceases. When the water level is lower than the designated area, the ultrasonic sensor sends alerts to the motor, and water starts to run into the water tray. When the water level is greater than the designated area, the ultrasonic sensor signals the motor, and the water flow stops. Fans are set up to adjust warmth within the fowl farm. To lessen high warmth, two fans are arranged in opposing directions, forcing air inward. To lessen cool warmth, two fans are arranged in opposing directions, forcing air outward. The setup is made for live oversight and to anticipate fowl farm atmospheric states using machine learning. Regular care, automatic warnings, and optimized feed and water direction further support a sound fowl-raising setting. Data gathered from sensors is stored in database platforms such as Firebase cloud, and the database info is linked to an app.

Keywords

Smart Poultry Farm,Node MCU,Arduino IDE,Firebase Cloud,Teacheable Machine,Android Application.

1. Introduction

Poultry farming plays a crucial role in feeding the growing global population, and maintaining a healthy farm environment is essential for efficient production and disease prevention.High Temperatures Leads to unbalanced environment conditions and low humidity favors to bacterial growth, and increase to the production of harmful gases like ammonia (NH_3) and carbon dioxide (CO_2), which causes poultry diseases and increases chicks death rate.

To address these challenges, this project integrates Machine Learning (ML) and the Internet of Things (Io T) to develop a real-time monitoring and automation system for poultry farms. The proposed system uses Io T sensors to continuously monitor key environmental conditions like temperature, humidity, food, water, and toxic gas levels. When harmful gas concentrations exceed safe limits, an automated neutralization process is triggered to maintain air quality.

Ultrasonic sensors detect food and water levels, automatically refilling trays when necessary. Temperature is can be regulated using fans, which manages the airflow to maintain heat and cold in poultry farm. The data which is collected from sensors are going to store in Firebase Cloud, ensuring seamless data processing and real-time access via a mobile or web application.

By applying machine learning algorithms, the system can predict disease outbreaks based on historical data patterns, helping farm managers take preventive measures. Automated alerts notify farm operators of any environmental risks, ensuring quick responses and minimizing losses. This smart poultry farm increases automation, improves disease identification, and optimizes resource management like food and water, at last it leading to a more productive and sustainable poultry farming environment.

2. Literature Survey

[1] Sylvia Ong Ai Ling and her team of researchers have developed an advanced smart monitoring system for poultry farming that utilizes sensors, including temperature and humidity sensors. This system uses the Internet of Things (Io T) to provide easy-to-implement features and solutions for poultry farms.

The project includes an application designed for monitoring chicks in poultry farms. It incorporates a DHT sensor to measure temperature and humidity in digital format, with the data transmitted to a Node MCU, specifically the ESP8266 micro controller. This micro controller is equipped with a Wi-Fi module, allowing project members to access real-time readings of temperature and humidity in the poultry farm.

The collected data is then sent to a cloud system that is the Blynk cloud which is Io T platform for IOS, and correspondingly displayed on a mobile application. Through this application, users can effectively monitor their poultry farms. The primary goal of this project is to enhance the management and efficiency of poultry farming.

[2] MD Roman Bhuiyan And Philipp Wree Discuss how chicken farming can be more productive. This project aids chicken raisers to generate income easily with internet-connected technologies and artificial intelligence, and we utilized productivity measures such as feed conversion ratio (FCR). This document details how digital technologies assist in overseeing chicken conditions and behavior. AI-driven sensors are utilized that observe fowl welfare, notably for broiler chickens. This initiative explores how AI and internet connectivity can automate fowl management, and this initiative enhances chicken output efficiency.

[3] Karun K C his team researchers had developed an Io T based Smart Poultry Management System .This research had focused on the advancing of poultry farm in the aspect of monitoring the temperature ,humidity ,feeding and water supply. In this project , the major aspects are regulation of temperature and regulation of humidity with the help of fans and heaters . This project aims to enhance the automation in food and water and to enhance the environmental factors like heat,cold and humidity. And the data through the WiFi module present in Node MCU will be transmitted to IOT cloud platform. In the poultry farms it requires labor for working in farm. The objective of this project is to interact wireless sensor networks to servers to send the data to devices of application. The components they used are Node MCU ,DHT11,L298 motor driver,ultrasonic sensor,LDR sensor and software they used are Arduino IDE to program the Node MCU ESP8266 board.

[4] **Olatayo M. Olaniyan** and his research team have created a prototype arrangement for the creation and execution of a Temperature and Humidity Regulation Arrangement for chicken coops. In this document, we utilize the ATMEGA328 microcontroller from Arduino, warmth sensors and moisture sensors, arrangement input, Liquid crystal display, servo motor, electric bulb, DC fan. For the sensing of warmth and moisture, they utilize the DHT sensor. And for the display, they utilize the i2c display. The initiative entails the automation of opening the windows of the chicken room. The initiative entails use of DC fans; with the aid of DC fans, the warm air is expelled from the room. For the regulation of heat, this initiative uses the electric bulb of 100 watts as a heat source for an increase of heat in the chicken room. In this initiative,

they utilize arrangement input to give the specific scope of warmth; the input segment comprises push buttons that are utilized to input specific warmth.

Table 1 : Comparision Table

S.No	Author Name	Hardware Components	Communication on Technology	Merits	Limitations
1.	Sylvia Ong Ai Ling	NodeMCU,ESP8266 Microcontroller,DHT22,Fan,Relay	WIFI	Real-Time Monitoring, Remote Access & Control,Automated Environmental Regulation,Cost-Effective,Energy Efficient.	Internet Dependency Limited Coverage Range Hardware Failures Cloud Reliance. Security Risks
2.	MD Roman Bhuiyan And Philipp Wree	Depth Cameras, Video Cameras, Thermal Imaging Sensors, Wearable Sensors, Kinect Sensor, RFID Readers, Electronic Scales	Internet of Things (IoT)	Improved Monitoring Data-Driven Decisions Enhanced Animal Welfare Efficiency	Technical Challenges Cost Data Overload Dependence on Technology
3.	Karun K C	Node MCU, DHT11, Ultrasonic sensor, LDR sensor, LED, Power supply, L298 Motor driver, servo motor	IoT Cloud Data	Automation,Real-Time Monitoring,Cost-Effective,Improved Productivity,Accessibility	Technical Skills Required Initial Setup Cost Dependence on Technology Environmental Factors
4.	Olatayo M. Olaniyan	Microcontroller, Temperature,	Wired Communication	Automated Control Real-Time Monitoring	Limited Wireless Capability

		Humidity Sensor, Display Unit, Control Mechanisms, Power Supply, Input Buttons		User-Friendly Interface Energy Efficiency	Dependency on Power Supply Initial Setup Complexity Single Sensor Limitation

3.Proposed Methodology

3.1 Components

3.1.1 Four Channel Relay Modules

Fig 1: 4 Channel Relay Module

Rely module has 4 channels which allows us to control 4 devices it is better and reliable with compatibility of Arduino and raspberry pi in four relays each of them control and manage 1 device module has including small led indicators to show does the relay is in activation or in deactivation the specification of this relay is this control the high voltage from controller.

3.1.2 Ultrasonic Sensors

Fig 2: Ultrasonic Sensor

To find the distance to an object this tool sends out a very high-pitched noise a sound wave that humans cannot hear when this noise reaches something it returns like an echo bouncing off a wall the device has a part that makes the noise and another part that hears the returning echo the tool figures out how far away the object is by timing how long it takes for

the noise to travel there and back if the echo returns very soon the object is near if the echo takes a while to return the object is distant this method provides information about an objects location.

3.1.3 Arduino

Fig 3: Arduino

Arduino could be a electric board employments for building and creating ventures the common smaller scale controller processor of Arduino is at mega 328p the Arduino comprises of input and output pins the control supply for the Arduino is getting frame outside that's by utilizing USB cable the Arduino has computerized and analog pins and underpins the c and c dialect and we utilize the program called Arduino IDE.

3.1.4 LCD Screen With i2c

Fig 4: LCD Screen With I2C

A small flat screen shaped like a box shows us information it uses numbers and letters to show things an adapter called i2c helps this screen talk to a little computer like the ones used in Arduino in smart chicken farms this screen with the i2c adapter shows us how hot or cold it is how much water is in the air and how much nitrogen and ammonia are present.

3.1.5 Servo Motor

Fig 5: Servo Motor

There's a motor that's really good at moving exactly where you tell it to it has a built-in sensor that tells it where it is so it knows if its in the right spot this makes it perfect for things like robots and toy cars that you control from far away it

listens to special signals like quick on-and-off pulses to change its angle and how fast it spins it can stay put in one place even if you push on it because of this these motors are very helpful in building machines and factories they are key to making sure things move smoothly and correctly in lots of different machines.

3.1.6 Node MCU With Sensor Shield

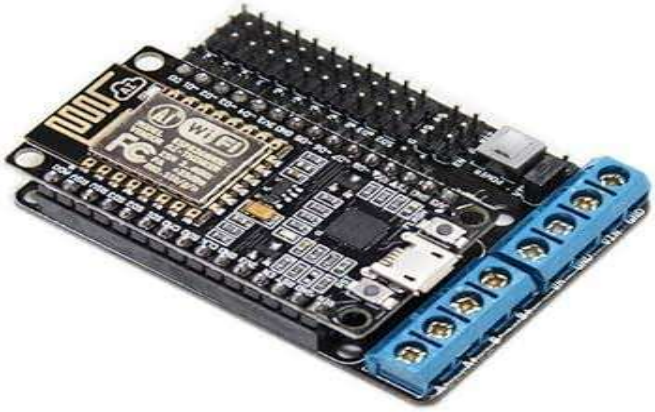

Fig 6: Node MCU With Sensor Shield

A widely used freely adaptable circuit board integrates a small computer with wireless internet access ideal for creating connected devices it centers on the esp8266 component facilitating simple online connection for various gadgets its straightforward coding setup lets users efficiently develop and transfer instructions using either the lua coding style or the Arduino software this board is excellent for both amateur builders and professional designers empowering them to construct intelligent systems and automate procedures its flexible nature and low cost make it a favored option for those wanting to explore the creation of interconnected technology.

3.1.7 MQ 2 In 1 Sensor

Fig 7: MQ 2 In 1 Sensor

A helpful sensor, the MQ-2, allows chicken farms to check the air. It senses things in the air, such as ammonia and nitrogen. By giving instant readings of harmful substances, it aids farmers in keeping their animals safe. This forward-thinking method safeguards the young chickens and encourages improved growth and overall farm output.

3.1.8 Coolant Fans

Fig 8: Coolant Fans

when temperatures rise its vital to protect young poultry from discomfort and harm this is why air-flow devices are necessary inside poultry farms these devices move air within the building lowering humidity and preventing young birds from becoming too warm and ill a space with good air movement and clean air supports the young poultry's wellness and allows them to grow as they should.

3.2 Working

This self-regulating chick-rearing facility employs a collection of measurement devices to constantly observe the young animals' surroundings. Conditions like warmth, moisture, and unsafe air components are tracked, and sound-wave distance detectors guarantee steady provision of nourishment and hydration. The central processing component, Node MCU, analyzes this data and initiates automatic actions. If warmth levels move beyond the ideal range, air-moving devices start to adjust air flow. When air-component detectors find raised levels of ammonia or nitrogen, purification devices activate to clean the air. Nourishment and hydration dispensers, guided by sound-wave readings, replenish supplies as needed, preventing shortages. A learning computer system examines the gathered information to detect patterns that may indicate chick sickness, and then provides potential solutions within the user interface. All measurement data and system conditions are stored in a cloud-based database, accessible via a user interface, enabling caretakers to oversee the facility from a distance, promoting a safe and productive space for the young creatures.

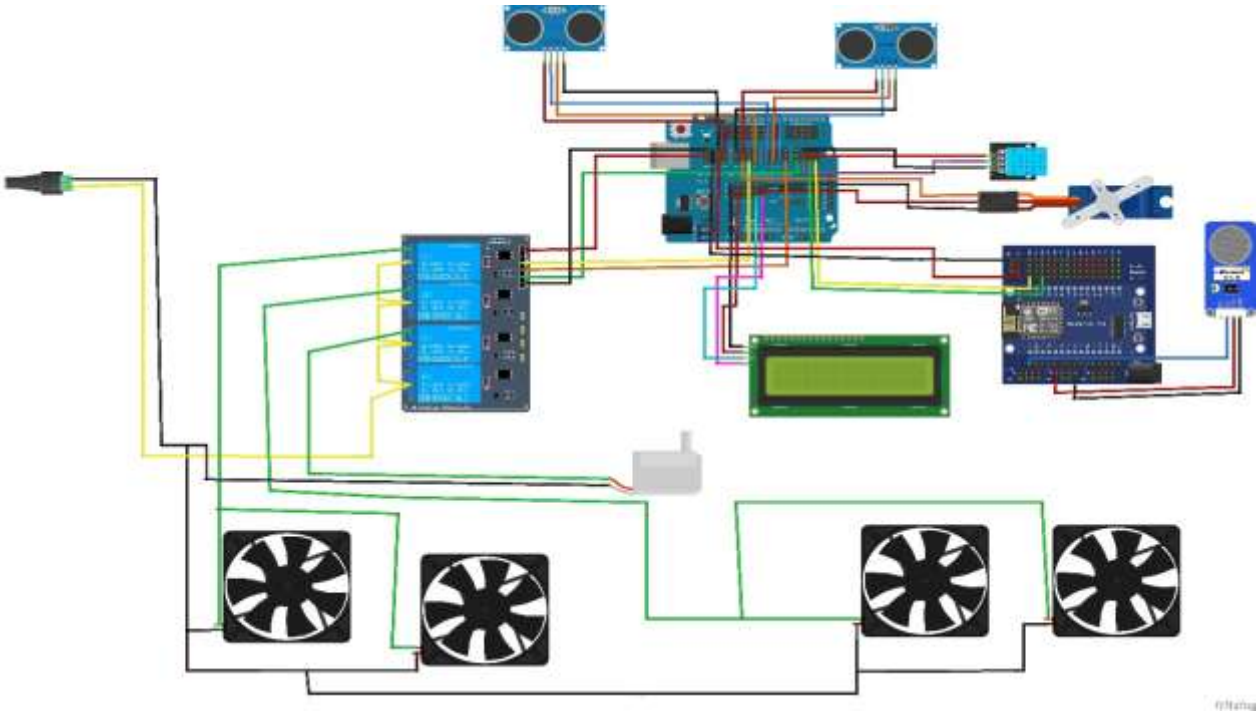

Fig 9: Circuit Diagram

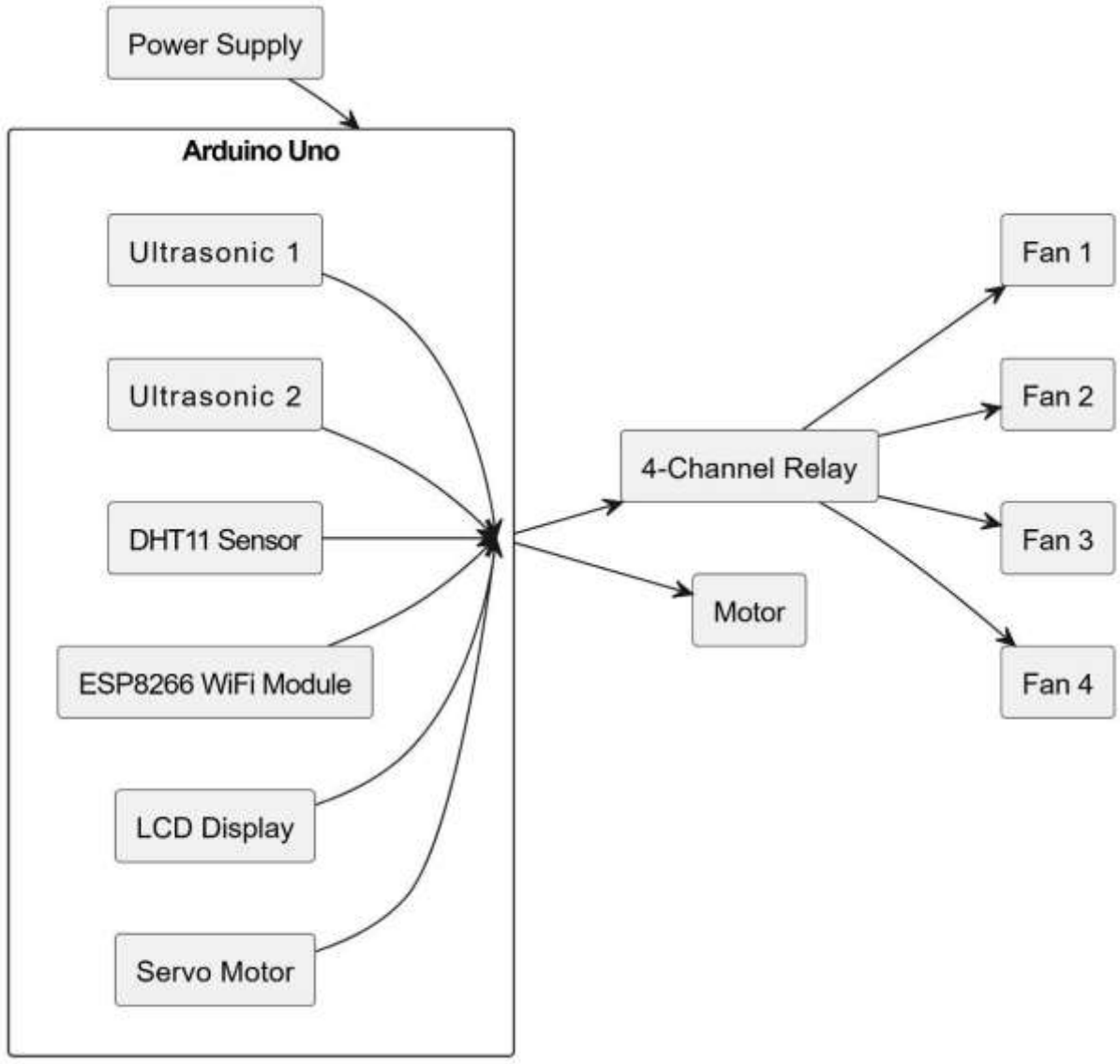

Fig 10 : Block Diagram

3.2.1 Data Collection

In this project data collection is carried out using the Wi-Fi module of the node MCU esp8266 micro controller operating continuously to ensure real-time functionality if any issues arise in the poultry farm users receive alerts via the app which provides readings for temperature humidity harmful gas concentration in the air and food and water levels in the trays the data collected by the Wi-Fi module is simultaneously transmitted to an i2c display and the fire base cloud after which it is sent to the end users application.

3.2.2 Data Processing

The Data processing is crucial to this project we collect data from the Wi-Fi module of the node MCU which is then transmitted to fire base we integrate fire base cloud with the node MCU using the API key and authentication key in the cloud platform we receive processed data readings including temperature hot state cool state food state water state nitrogen and ammonia levels the project was executed without any coding errors ensuring low latency in data processing.

3.2.3 Data Storage and Analysis

The data we collected is displayed on the fire base cloud platform where we also store the poultry farm readings and this platform was easy to use and its having a good interface for displaying of readings and data is stored in an on/off format allowing us to do perform analysis to monitor the readings this data helps identify any frequent changes of the readings end users will receive live updates on the readings from the poultry farm.

3.2.4 Working with fire base Cloud

In this project we was going utilize fire base cloud to gather data on temperature nitrogen no2 ammonia nh3 hot state cool state food state and water state fire base will indicate whether the cool and hot states are active or inactive as well as provide readings for temperature hot state and cool state additionally it will show the status of the water and food states we will transmit this fire base data to a mobile application for monitoring the poultry farm.

4. Result and Discussion

4.1 DHT 11 Sensor

Fig 11:DHT 11 Sensor

Fig 11 represents the the readings of temperature and humidity which are fetched from DHT11 sensor. It is used to detect the whether poultry farm temperature are decreased/increased than the marked region

4.2 MQ 2 In 1 Sensor

Fig 12: Firebase Cloud

Fig 12 represents the gas concentration in air which are fetched from MQ 2 in 1 sensor. In the I2C display we can see the harmful gases like Nitrogen and Ammonia percentage in air.

4.3 Ultrasonic Sensor

Fig 13: Monitoring Food

Fig 14: Monitoring Water

Fig 13 shows the use of ultrasonic sensor for knowing whether the food is there in the tray up to mark up region or not.Fig 14 shows the use of ultrasonic sensor for knowing whether the water is there in the tray up to mark up region or not.

4.4 Application For Monitoring And Disease Detection

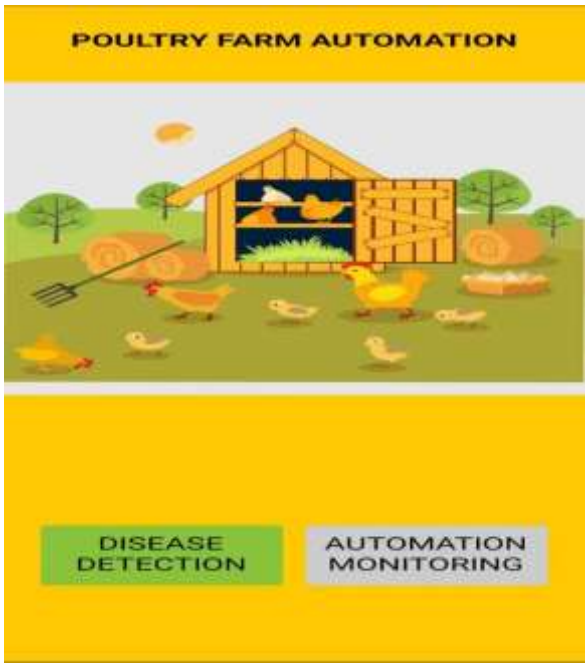

Fig 15: Home page

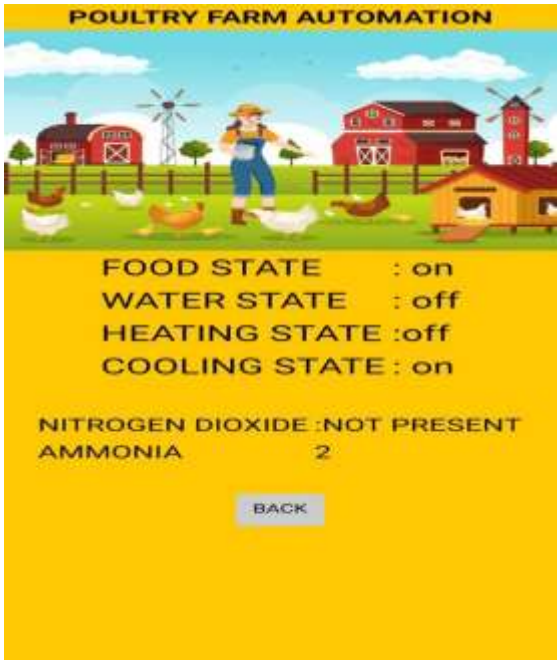

Fig 16: Automation Monitoring Page

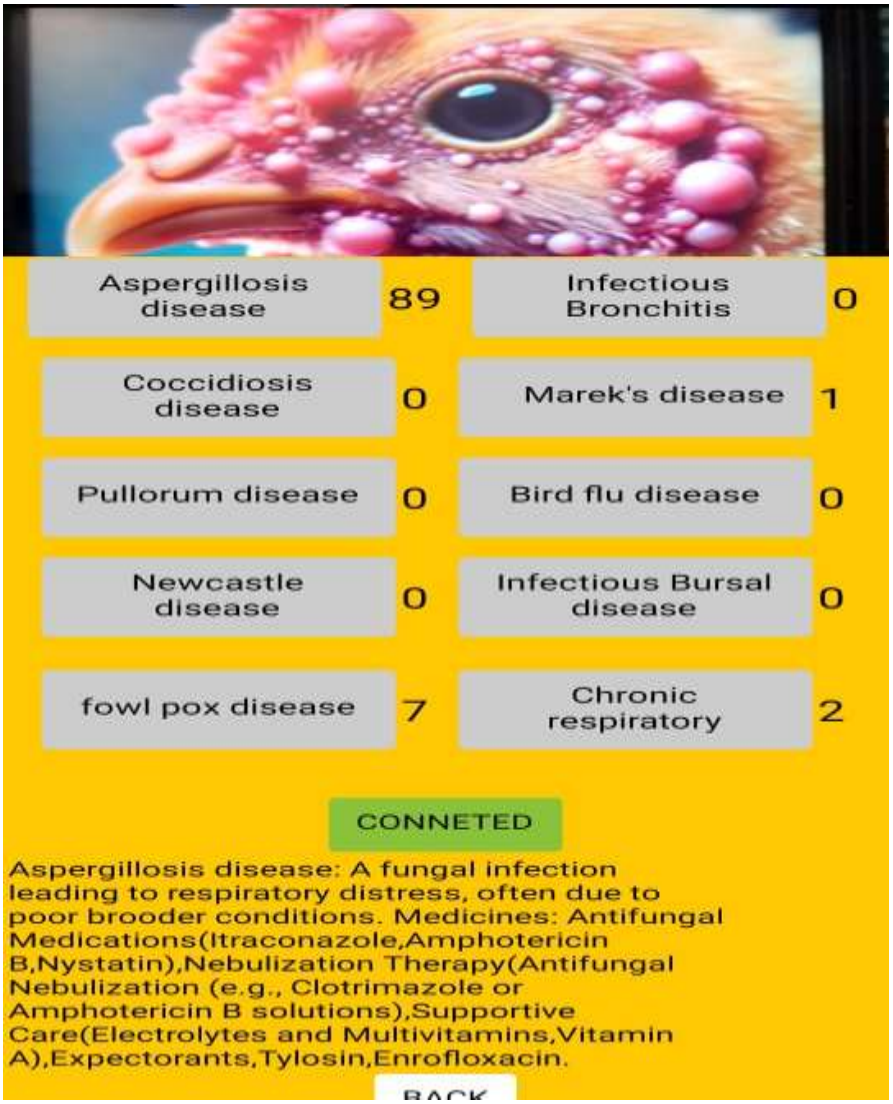

Fig 17: Disease Detection Page

Fig 15 indicates home page and home page has two buttons.The one buttons named as disease detection and another button named as automation monitoring.Fig 16 automate and monitor the poultry farm and this includes food state,water state,heating state,cooling state and this page shows the level of nitrogen dioxide and ammonia.Fig 17 represent the identification of disease detection.This page give explanation about disease and give medicine to that particular disease for curing.

Conclusion:

Combining Machine Learning (ML) with connected devices in chicken rearing offers a revolutionary method for improving farm oversight and bird health. By utilizing up-to-the-minute surveillance setups, this technology allows for accurate regulation of key climate elements, including heat levels, moisture content, and gas levels, specifically harmful emissions like ammonia (NH_3) and carbon dioxide (CO_2). The automatic processes, powered by detection devices and ML logic, effectively forecast and lessen illness dangers, guaranteeing ideal situations for fowl development and yield. Mechanization of vital supplies such as nourishment and hydration, supported by sound wave detectors, reduces waste and guarantees steady availability, while temperature modification through strategically positioned air movers keeps a balanced atmosphere. The utilization of cloud-based storage solutions like Firebase for information archiving and application connection further improves accessibility and informed choices for agricultural managers. In summary, this novel setup not just boosts effectiveness and lessens human labor, but also fosters a healthier and longer-lasting avian husbandry environment through preventative upkeep, immediate notifications, and information-based understanding..

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