UNIVERSITY OF ENGINEERING AND TECHNOLOGY TAXILA (UET)

COMPUTER SCIENCE ENGINEERING DEPARTMENT

Project

Revolutionizing Poultry Farming: The Smart Control Cage System

For

Fifth Semester

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Table of Contents

REVOLUTIONIZING POULTRY FARMING: THE SMART CONTROL CAGE SYSTEM

Problem Statement:

"Revolutionizing Poultry Farming: The Smart Control Cage System" aims to tackle the challenges faced by poultry farmers in Pakistan by introducing IoT-based automation to optimize chicken health and farm efficiency. With the increasing demand for chicken output, it is essential to implement standardized farm management and effective manufacturing procedures. However, manual monitoring and regulation of environmental elements such as temperature, humidity, light, and ammonia gas, as well as tasks such as meal feeding, water supply, and sanitation, can be time-consuming and labor-intensive. Our solution utilizes IoT technology to streamline these processes, allowing farmers to focus on the growth and well-being of their birds, while also improving productivity and reducing costs.

Abstract:

"Revolutionizing Poultry Farming" is a phrase that captures the attention of farmers and industry professionals alike. The poultry farming industry is facing new challenges with the growing demand for chicken output. However, there is a solution that aims to tackle these challenges head-on. Introducing the Smart Control Cage System, an IoT-based technology that optimizes chicken health and efficiency. However, there is a solution that aims to tackle these challenges head-on. Introducing the Smart Control Cage System, an IoT-based technology that optimizes chicken health and efficiency.

The Smart Control Cage System automates manual monitoring and regulation of environmental elements such as temperature, humidity, light, and ammonia gas, as well as tasks such as meal feeding, water supply, and sanitation. This allows farmers to focus on the growth and well-being of their birds, while also improving productivity and reducing costs. The system offers real-time monitoring, alerts and advanced controls for meal feeding and water supply, with easy integration with other farm management software.

The Smart Control Cage System empowers poultry producers to streamline their operations and make better decisions, thus becoming more efficient, and cost-effective. It is a state-of-the-art solution that provides farmers with the tools they need to improve the health and efficiency of their birds, while also reducing costs. With the ability to monitor and control environmental elements, meal feeding and water supply, this system helps farmers to focus on the well-being of their birds and make better decisions about their operations.

Introduction:

Poultry farming is a rapidly growing industry in Pakistan, with chicken output on the rise due to improved farm management and manufacturing procedures. However, as the demand for chicken output continues to increase, farmers are facing new challenges that come with traditional methods of monitoring and regulating environmental elements and tasks like meal feeding, water supply, and sanitation. But there is a solution that aims to tackle these challenges head-on. Introducing the Smart Control Cage System, an IoT-based technology that revolutionizes the way farmers approach poultry farming.

The Smart Control Cage System is designed to optimize chicken health and farm efficiency by automating manual monitoring and regulation of environmental elements such as temperature, humidity, light, and ammonia gas, as well as tasks such as meal feeding, water supply, and sanitation. The system offers advanced sensors and controls that can monitor everything from temperature and humidity to feed and water levels. Additionally, the cage can be easily integrated with other farm management software, allowing farmers to keep track of all aspects of their operation from a single, centralized location.

The Smart Control Cage System empowers poultry producers to streamline their operations, improve productivity and reduce costs, which is a key to their success in a competitive market. It provides farmers with real-time monitoring and alerts, allowing them to quickly respond to any issues that may arise. This can help to prevent problems such as disease outbreaks and ensure that the birds are kept in optimal conditions at all times. The system also includes advanced controls for meal feeding and water supply, ensuring that the birds are always well-nourished and hydrated.

Not only does this system improve the health and well-being of the birds, but it also reduces the need for manual labor, freeing farmers to focus on other aspects of their operation. It also provides data and analytics for better decision making. With the Smart Control Cage System, farmers can easily monitor and manage their entire operation, from the comfort of their own home or office, using a simple and intuitive interface. In short, the Smart Control Cage System is a game-changer in the poultry farming industry that revolutionizes the way farmers approach poultry farming.

In addition to the current benefits, the Smart Control Cage System also has a promising future aspect. As IoT technology continues to advance, the system will be able to incorporate new features and capabilities such as predictive analytics, machine learning and AI. This will further optimize chicken health and efficiency and allow farmers to make more informed decisions about their operation. The system will also be able to integrate with other smart farming technologies, such as precision agriculture and precision livestock farming, creating a truly connected and intelligent farm environment. With its ability to adapt and evolve, the Smart Control Cage System is not only a solution for today, but also a future-proof investment for any poultry farmer looking to stay ahead of the curve.

The Problem with Traditional Poultry Farming:

Traditional poultry farming methods can present several problems, including:

1. **Overcrowding:**

   Poultry farms often house large numbers of birds in small spaces, leading to overcrowding and poor living conditions for the birds. This can increase the risk of disease transmission and negatively impact the welfare of the birds.
2. **Disease Outbreaks:**

   Due to proximity of birds, traditional poultry farming methods can make it easier for diseases to spread. This can lead to significant financial losses for farmers due to bird deaths and reduced productivity.
3. **Poor Welfare of Birds:**

   Traditional methods may not provide adequate space, lighting, or enrichment for the birds, leading to poor welfare. This can cause birds to be stressed or suffer from behavioral or health issues.
4. **Environmental Impact:**

   Traditional poultry farming methods can also have negative environmental impacts, such as waste disposal, manure management, and use of water and energy.
5. **Food safety concerns:**

   Traditional poultry farming methods may lead to contamination of the birds and their products with harmful bacteria such as salmonella and campylobacter.

Traditional poultry farming methods can present problems such as overcrowding, disease outbreaks, poor welfare of birds, environmental impact, food safety concerns and antibiotic resistance which can lead to lower productivity, increased costs, and negative impact on welfare of birds and environment. The Smart Control Cage system aims to address these problems by providing a more efficient and humane method of poultry farming by automating the monitoring and control of environment, food, water, and temperature inside the cage.

The Solution: The Smart Control Cage System:

Revolutionizing Poultry Farming Introducing the Smart Control Cage System, a state-of-the-art technology that is set to revolutionize the poultry farming industry. The system is designed to address the common problems associated with traditional poultry farming methods, such as overcrowding, disease outbreaks, and poor welfare of the birds.

The Smart Control Cage System is equipped with a range of advanced features, including:

1. Temperature control:

   The system includes a temperature sensor that is used to measure the temperature within the cage. If the temperature falls outside of a predefined range, the system will activate the fan or bulb to adjust the temperature to the desired level. This ensures that the birds are kept at a comfortable temperature, which can improve their welfare and reduce the risk of disease.

2. Water level control:

   The system includes a water level sensor that is used to measure the water level in the system. If the water level falls below a predefined level, the system will activate the water motor to refill the water supply. This ensures that the birds always have access to fresh water and prevents wastage of water.

3. Feed control:

   The system includes an ultrasonic sensor that is used to measure the level of feed in the feed box. If the feed level falls below a predefined level, the system will activate the servo motor to refill the feed box. This ensures that the birds always have access to food and prevents wastage of feed.

4. Air Quality control:

   The system includes an Ammonia (NH4) sensor that is used to measure the level of Ammonia in the air within the cage. If the level of Ammonia exceeds a predefined level, the system will activate the ventilation system to improve the air quality. This ensures that the birds are breathing fresh and clean air and prevents health issues caused by poor air quality.

With these advanced features, the Smart Control Cage System provides a more efficient and humane method of poultry farming, improving bird welfare, reducing disease transmission, and increasing efficiency. The system's sensors help in monitoring and controlling the environment inside the cage, providing a better living condition for the Chicken. The Smart Control Cage System is the future of poultry farming and is poised to revolutionize the industry.

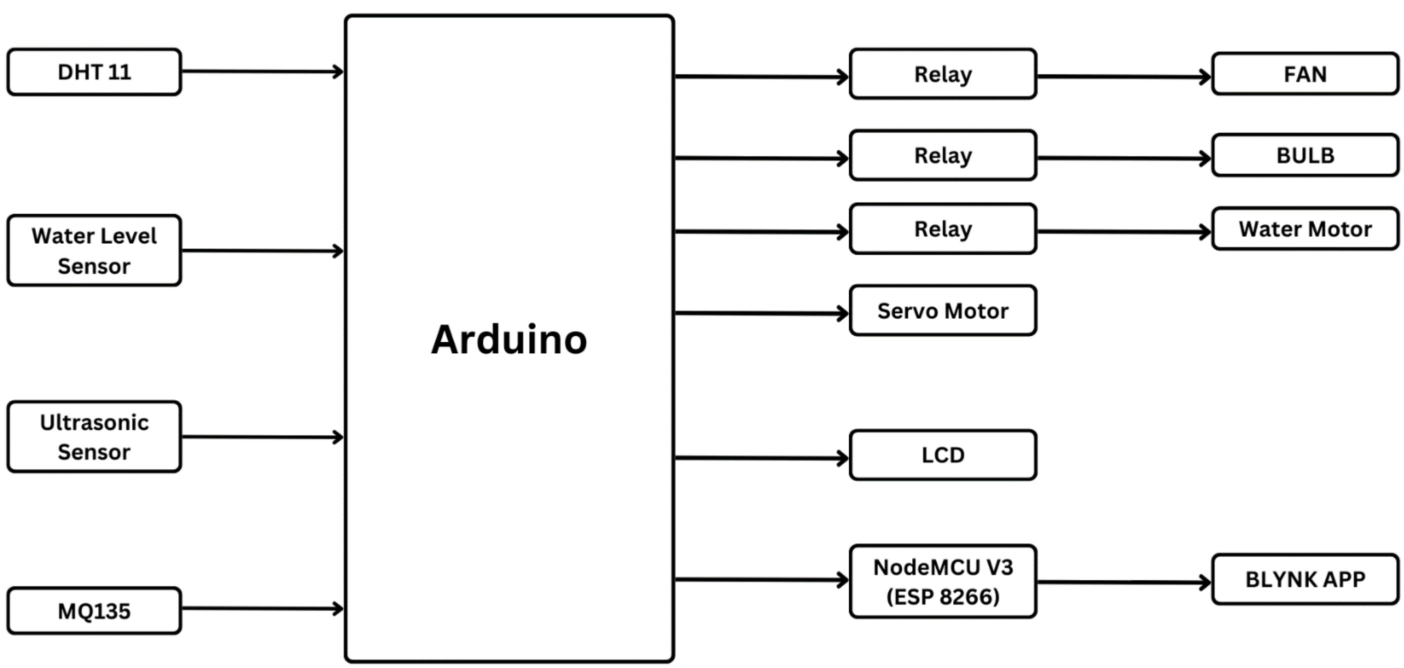
Implementation and Impact on Poultry Farming:

Implementation of the Smart Control Cage System would involve the integration of the technology into existing poultry farming operations. This would likely involve the installation of the necessary equipment and sensors, as well as the development of software and control systems to manage the system. The process of implementation would also involve training and education for farmers and other industry professionals on how to use and maintain the system.

The impact of the Smart Control Cage System on poultry farming would be significant. The system's ability to automatically control temperature, water level, feed, and air quality would lead to improved bird welfare, and increased efficiency. This would likely result in increased productivity and profitability for farmers, as well as a reduction in the environmental impact of poultry farming.

Overall, the Smart Control Cage System has the potential to revolutionize the poultry farming industry by providing a more efficient and humane method of raising birds. It could lead to improved welfare for birds, increased productivity and profitability for farmers, and a reduction in the environmental impact of poultry farming.

The Architecture of the Smart Control Cage System:



1.1 fig: A comprehensive look at the Smart Control Cage System: Block Diagram of the Circuit

The Components Requirement of the Smart Control Cage System:

1. Microcontroller:

1. Arduino UNO:

   Arduino Uno serves as the "brain" of the system, used for controlling the system and coordinating the actions of the various components. The microcontroller receives data from the sensors, processes the data and controls the fans, bulbs, water motor, and servo motor based on the received data.

2. NodeMCU V3 (ESP8266):

   NodeMCU V3 (ESP8266) is used for collecting and transmitting data from the sensors to a remote location. This component can receive data from the sensors and send this data to the Blynk app via Wi-Fi.

2. Sensors:

1. DHT11 sensor:

   DHT11 sensor is used for measuring temperature and humidity in the poultry cage. This sensor can measure the temperature and humidity in the environment and send this data to the microcontroller.

2. Water level sensor:

   A water level sensor is used for monitoring the water supply in the cage. This sensor can detect the water level in the tank and send this data to the microcontroller.

3. Ultrasonic sensor:

   Ultrasonic sensor is used for measuring the level of feed in the feed box. This sensor can detect the level of feed in the feed box and send this data to the microcontroller.

4. MQ135 sensor:

   MQ135 sensor is used for measuring the level of ammonia in the cage, which is an important factor in maintaining the health of the birds. This sensor can detect the level of ammonia in the cage and send this data to the microcontroller.

3. Control Mastery Components:

1. Fan:

   Fans are used for regulating the temperature in the cage. The microcontroller (Arduino Uno) can control the speed of the fans based on the temperature data received from the DHT11 sensor.

2. Bulb:

   Bulbs are also used for regulating the temperature in the cage. The microcontroller (Arduino Uno) can control the on/off bulbs based on the temperature data received from the DHT11 sensor.

3. Water motor:

   Water motor is used for controlling the water supply in the cage. The microcontroller (Arduino Uno) can control the water motor based on the water level data received from the water level sensor.

4. Servo motor:

   Servo motor is used for controlling the feed box, ensuring that the birds always have access to feed. The microcontroller (Arduino Uno) can control the servo motor based on the feed level data received from the ultrasonic sensor.

4. Supporting materials:

1. Blynk app:

   Blynk app is used for monitoring and controlling the system remotely. This app can receive data from the NodeMCU V3 (ESP 8266) and display it in a user-friendly interface. Users can also control the system remotely using the Blynk app.

2. Arduino IDE:

   The Software for Programming the Microcontroller and Connecting to the Blynk App. This software provides a user-friendly interface for writing and uploading code to the microcontroller.

3. Relay:

   Acts as a switch. Therefore, here relay circuit is used which is capable of handling and switching high voltage circuits.

4. Power Supply and Wiring:

   The power supply and wiring are crucial components of the smart control system for poultry farming. They ensure that the system has a stable power supply to function properly and all the components are connected correctly.

Methodology:

1. *Sensor selection and implementation:*

1. The DHT11 sensor is for measuring temperature and humidity, allowing for a comfortable climate for the chickens.
2. A water level sensor for monitoring water levels, ensuring the chickens always have access to fresh water.
3. An ultrasonic sensor for measuring the level of feed in a feed box, guaranteeing the chickens never go hungry.
4. An MQ135 sensor for measuring ammonia levels, maintaining a healthy and safe environment for the chickens.

2. *Control system:*

Utilize the data collected by the sensors to create a dynamic and responsive environment for the poultry, such as:

1. When the temperature rises, the fan automatically turns on to keep the chickens cool and comfortable.
2. When the temperature drops, the bulb automatically turns on to keep the chickens warm.
3. If the water level decreases, the water motor automatically starts to refill the water supply, ensuring the chickens never go thirsty.
4. Using the ultrasonic sensor to measure the level of feed in the feed box, when the level is low, the servo motor automatically opens the feed box and fills it with feed to ensure the chickens always have a bountiful feast.

3. *Data transmission:*

Send the sensor data to a NodeMCU V3 (ESP8266) which can then send the data to a Blynk app for monitoring and control purposes, allowing you to always keep an eye on your chickens.

4. *Automation and optimization:*

1. Automate various aspects of the poultry farming process by using the data from the sensors to control the environmental conditions and feed levels in the cage system, making your life easier and your chickens happier.
2. Optimize the farming process by using the data from the sensors to adjust the environment and feed levels in the cage system for the best possible outcome for the poultry, ensuring your chickens thrive.

5. *Evaluation:*

1. Monitor the poultry farming process with the Blynk app, and evaluate the performance of the system over time, making improvements as needed.
2. Adjust as needed to optimize the system and improve the overall outcomes for the poultry, ensuring your chickens are living their best lives.

Code: The Technical Aspects of the Smart Control Cage System:

1. The Technical Aspects of the Smart Control Cage System on Arduino Uno:

The code is the backbone of the Smart Control Cage System and use several powerful libraries to control various components of the system. The script starts by importing these libraries and setting parameters such as pin numbers for sensors, motors, threshold temperatures for turning on the fan and bulb, and other constants like the maximum distance for the ultrasonic sensor.

In the setup function, it sets up communication with the microcontroller, initializes the Liquid Crystal Display (LCD), sets the pin modes for the fan, bulb, water level sensor and motor, attaches the servo motor, and initializes the DHT and MQ135 sensors.

The loop function continuously monitors the temperature, humidity, water level, feed level and NH4 level using the various sensors and maps the values to percentage. It also controls the fan and bulb according to the temperature threshold values, controls the water motor and servo motor according to the water level and feed level respectively and checks the NH4 levels and triggers a ventilation system if it exceeds a certain level to improve the air quality.

The code also prints the values to the serial monitor for debugging and sends them to the LCD for display, ensuring that the system runs smoothly and effectively. It's like having a virtual farm manager that takes care of all the essential parameters of the poultry farm automatically.

Control Poultry Cage.ino

```
// Include the library
#include <SoftwareSerial.h>
#include <DHT.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <Servo.h>
#include <NewPing.h>
#include <MQ135.h>
#include <SPI.h>

#define TRIGGER_PIN 5
#define ECHO_PIN 4
#define MAX_DISTANCE 100 // Maximum distance (in cm) that the ultrasonic sensor can measure
#define SERVO_PIN 10

Servo servo;
NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE);

```

```
#define DHT_TYPE DHT11   // Define the type of the DHT sensor
const int DHT_PIN = 2;   // Pin where the DHT sensor is connected
const int FAN_PIN = 13;  // Pin where the fan is connected
const int BULB_PIN = 12; // Pin where the bulb is connected
int sensorPin = A0;      // select the input pin for the water level sensor
int motorPin = 11;       // select the output pin for the motor

#define MQ135_PIN 3     // Pin for MQ135 sensor
#define RLOAD 1.0
#define r0Air 1
#define scaleFactorNH4 102.694
#define exponentNH4 2.48818
#define atmNH4 15

// Set the LCD address to 0x27 for a 16 chars and 2 line display
LiquidCrystal_I2C lcd(0x27, 16, 2);

const int TEMP_THRESHOLD_HIGH = 40;  // Threshold temperature for turning on the fan
const int TEMP_THRESHOLD_LOW = 20;   // Threshold temperature for turning on the bulb

DHT dht(DHT_PIN, DHT_TYPE);  // Create an instance of the DHT library
MQ135 gasSensor = MQ135(MQ135_PIN, RLOAD, r0Air);
```

```
void setup() {
  Serial.begin(9600);        // Initialize serial communication
  lcd.begin();                 // initialize the lcd
  lcd.backlight();             // turn on the backlight
  pinMode(FAN_PIN, OUTPUT);    // Set the fan pin as an output
  pinMode(BULB_PIN, OUTPUT);   // Set the bulb pin as an output
  pinMode(sensorPin, INPUT);   // set the sensor pin as an input
  pinMode(motorPin, OUTPUT);   // set the motor pin as an output
  servo.attach(SERVO_PIN);     //connect servo motor
  dht.begin();                 // Initialize the DHT sensor
}

void loop() {
  // Read the temperature and humidity from the DHT sensor
  float temperature = dht.readTemperature();
  float humidity = dht.readHumidity();

  // read the water level sensor value
  int sensorValue = analogRead(sensorPin);

  // Measure the distance of feed box
  int feedlevel =  sonar.ping_cm();

  // Measure the feedlevel in percentage
  if (feedlevel <= 9) {
    feedlevel = ((11-feedlevel*0)/11)*100;
  }
  else if (feedlevel == 10) {
    feedlevel = ((11-feedlevel*0.5)/11)*100;
  }
  else if (feedlevel >= 11) {
    feedlevel = ((11-feedlevel)/11)*100;
  }
```

```

    // Measure NH4 levels
    int val1 = analogRead(MQ135_PIN);
    int val = 74;
    float resistance = ((1024/(float)val) * 5 - 1)* RLOAD;
    float r0NH4 = resistance * pow((atmNH4/scaleFactorNH4), (1./exponentNH4));
    float NH4=scaleFactorNH4 * pow((resistance/r0NH4), -exponentNH4);

    // convert the sensor value to a water level percentage
    int waterlevel = map(sensorValue, 0, 1023, 0, 100);

    // Print the values to the serial monitor
    Serial.print("\n");
    Serial.print(temperature);
    Serial.print(" ");
    Serial.print(humidity);
    Serial.print(" ");
    Serial.print(waterlevel);
    Serial.print(" ");
    Serial.print(feedlevel);
    Serial.print(" ");
    Serial.print(NH4);
    Serial.print(" ");
```

```

    // Display the values on the LCD
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Temp: ");
    lcd.print(temperature);
    lcd.print("*C");
    lcd.setCursor(0,1);
    lcd.print("Humidity: ");
    lcd.print(humidity);
    lcd.print("%");
    delay(3000);
    lcd.clear();
    lcd.setCursor(1,0);
    lcd.print("Water Level: ");
    lcd.print(waterlevel);
    lcd.print("%");
    lcd.setCursor(0,1);
    lcd.print("Feed Level: ");
    lcd.print(feedlevel);
    lcd.print("%");
    delay(3000);
    lcd.clear();
    lcd.setCursor(3,0);
    lcd.print("NH4: ");
    lcd.print(NH4);
    lcd.print("ppm");
```

```
  // Control the fan based on the temperature
  if (temperature > TEMP_THRESHOLD_HIGH)
  {
    digitalWrite(FAN_PIN, HIGH);  // Turn on the fan
  }
  else
  {
    digitalWrite(FAN_PIN, LOW);  // Turn off the fan
  }

  // Control the bulb based on the temperature
  if (temperature < TEMP_THRESHOLD_LOW) {
    digitalWrite(BULB_PIN, HIGH);  // Turn on the bulb
  }
  else
  {
    digitalWrite(BULB_PIN, LOW);
  }

  // start the motor if the water level is less than 20%
  if (waterlevel < 20) {
    digitalWrite(motorPin, HIGH);
  }
  else {
    digitalWrite(motorPin, LOW);
  }

  // start the servo motor if the feed level is less than 20%
  if (feedlevel = 0) {
    servo.write(45); // Rotate the servo to the 90 degree position
  }
  else{
    servo.write(160); // Rotate the servo back to the 0 degree position
  }
  delay(3000);
}
```

Output   Serial Monitor

```
Sketch uses 9784 bytes (30%) of program storage space. Maximum is 32256 bytes.
Global variables use 599 bytes (29%) of dynamic memory, leaving 1449 bytes for local variables. Maximum is 2048 bytes.
```

2. The Technical Aspects of the Smart Control Cage on NodeMCU V3 (ESP 8266):

The NodeMCU v3 (esp8266) is a tiny microcontroller that can connect to the internet and send data to the Blynk app on your phone. It uses a software serial connection to communicate with an Arduino, which is measuring the temperature, humidity, water level, feed level, and NH4 levels inside the cage. The NodeMCU v3 (esp8266) takes that data and sends it to the Blynk app, where you can see it in real-time.

You can set up the NodeMCU v3 (esp8266) with your Wi-Fi credentials, and it will connect to the internet and start sending data to the Blynk app. The Blynk app is a powerful tool that allows you to create a customized dashboard, where you can see all the sensor data in one place. You can even set up virtual pins to control different devices on the farm remotely.

IOT Bylink.ino

```
// Template ID, Device Name and Auth Token are provided by the Blynk.Cloud
// See the Device Info tab, or Template settings

#define BLYNK_TEMPLATE_ID "TMPL3v_TPjlE"
#define BLYNK_DEVICE_NAME "Control Poultry Cage"
#define BLYNK_AUTH_TOKEN "6luXhSVMPLKZj0rXkf-7FBIlL0qixAQi"


#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include<SoftwareSerial.h>

SoftwareSerial mySerial (D1, D2); //Rx, TX pins

char auth[] = BLYNK_AUTH_TOKEN;

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Subhan-Ali";
char pass[] = "NahiBataonga12!";

BlynkTimer timer;

void setup()
{
  // Debug console
  Serial.begin(115200);
  mySerial.begin(9600);

  Blynk.begin(auth, ssid, pass);
  // You can also specify server:
  //Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
  //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8080);
}
```

```
// This function sends Arduino's uptime every second to Virtual Pin 2.
void myTimerEvent()
{
  // You can send any value at any time.
  // Please don't send more that 10 values per second.
  Blynk.virtualWrite(V2, millis() / 1000);
}

void loop()
{
  Blynk.run();
  timer.run();

  // put your main code here, to run repeatedly:
  String msg = mySerial.readStringUntil('\r');

  //Extract values from the string and store them in variables
  String values[5]; //create an array to store the values
  int i = 0;
  for (int j = 0; j < msg.length(); j++) {
    if (msg[j] == ' ' || msg[j] == '\r') { //check for a space or a newline character
      i++;
    }
    else {
      values[i] += msg[j]; //add the current character to the current value string
    }
  }

  float temperature = values[0].toFloat();
  float humidity = values[1].toFloat();
  int waterlevel = values[2].toFloat();
  int feedlevel = values[3].toFloat();
  float NH4 = values[4].toFloat();

  if (NH4 != 0){
    // Print the temperature and humidity to the serial monitor
    Serial.print("Temperature: ");
    Serial.print(temperature);
    Serial.println(" C");
    Serial.print("Humidity: ");
    Serial.println(humidity);
    Serial.print("Water Level: ");
    Serial.print(waterlevel);
    Serial.println(" %");
    Serial.print("Feed Level: ");
    Serial.print(feedlevel);
    Serial.println(" %");
    Serial.print("NH4 PPM: ");
    Serial.print(NH4);
    Serial.println(" ppm");

```

```
    // send the sensor data to virtual pin V0
    Blynk.virtualWrite(V4, waterlevel);
    Blynk.virtualWrite(V5, humidity);
    Blynk.virtualWrite(V6, temperature);
    Blynk.virtualWrite(V7, feedlevel);
    Blynk.virtualWrite(V8, NH4);
  }
  else{
    Serial.println("Wait...");
  }
  delay(6000);
}
```

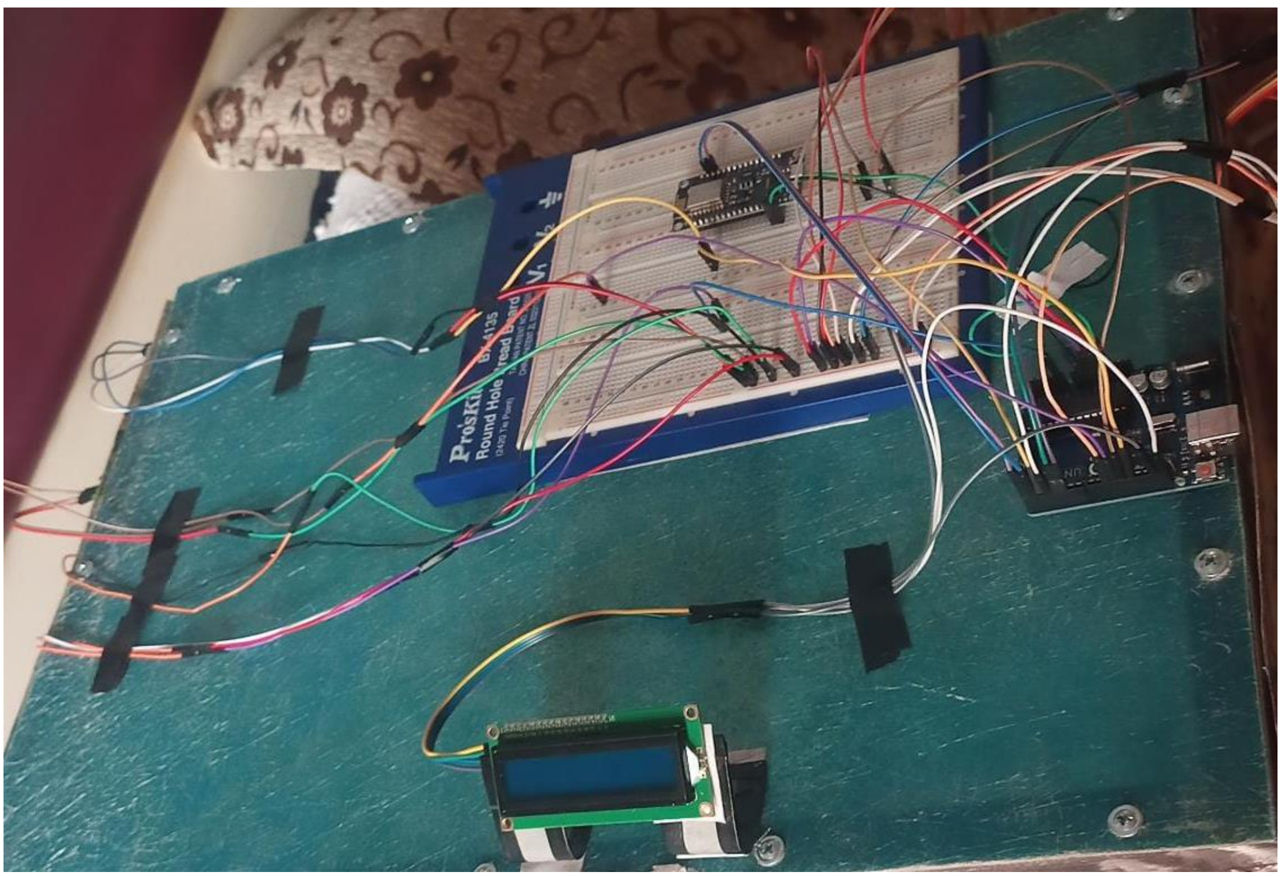
utput   Serial Monitor

```
. Variables and constants in RAM (global, static), used 30908 / 80192 bytes (38%)
║   SEGMENT  BYTES    DESCRIPTION
╠══ DATA     1564     initialized variables
╠══ RODATA   2208     constants
╚══ BSS      27136    zeroed variables
. Instruction RAM (IRAM_ATTR, ICACHE_RAM_ATTR), used 62827 / 65536 bytes (95%)
║   SEGMENT  BYTES    DESCRIPTION
╠══ ICACHE   32768    reserved space for flash instruction cache
╚══ IRAM     30059    code in IRAM
. Code in flash (default, ICACHE_FLASH_ATTR), used 256436 / 1048576 bytes (24%)
║   SEGMENT  BYTES    DESCRIPTION
╚══ IROM     256436   code in flash
```

The Hardware Blueprint of the Smart Control Cage System:

1. Circuit:

The Circuit of the Smart Poultry Cage System is the backbone of the system, it comprises of all the electrical connections and components that make the system work. The circuit includes a microcontroller, such as an Arduino Uno, which acts as the brain of the system. It receives input from the various sensors in the system, such as the DHT11 sensor for measuring temperature and humidity, a water level sensor for monitoring water levels, an ultrasonic sensor for measuring the level of feed in a feed box, and an MQ135 sensor for measuring ammonia levels. These sensors provide data on the environmental conditions in the cage system, which the microcontroller uses to control the various components of the system, such as the fans, bulbs, water motor, and servo motor, which are used to control temperature, water levels, and feed levels respectively. The system also includes a NodeMCU V3 (ESP8266) for data collection and transmission, it receives data from the sensors and sends it to the Blynk app for monitoring.



2.1 fig: The Smart Control Cage System Design

2. Temperature Management:

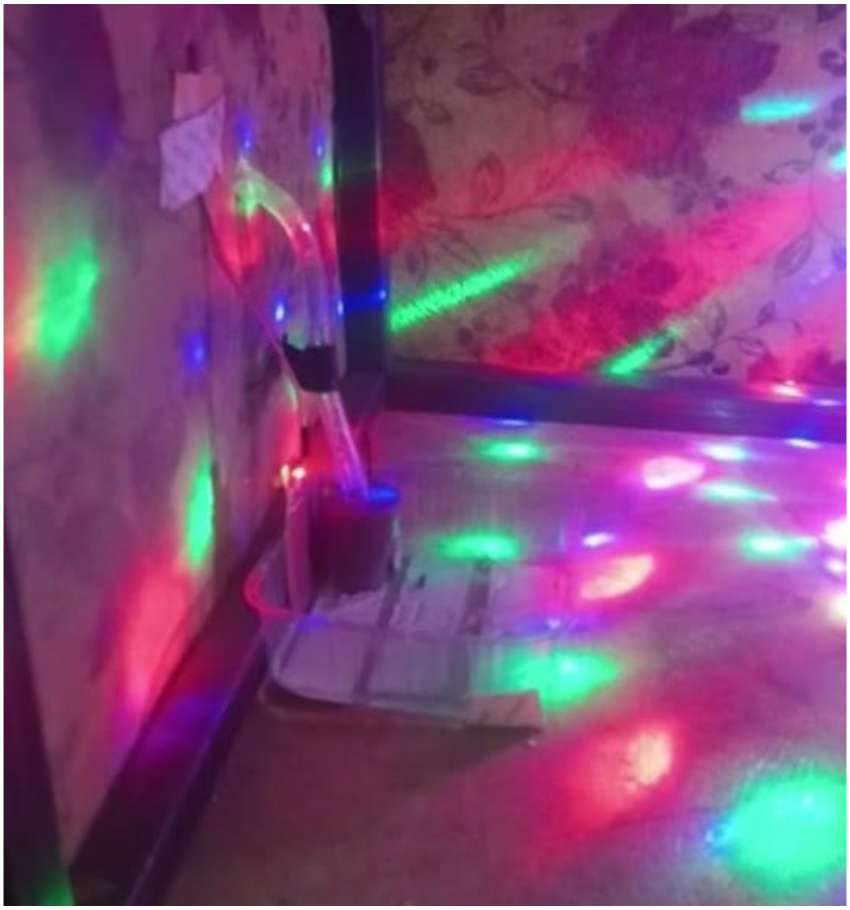
1. The DHT11 sensor is used to measure the temperature and humidity in the cage system.
2. The data from the sensor is used to control the fan and bulb to maintain a comfortable climate for the chickens, providing them with the ideal environment to thrive.
3. The fan is automatically turned on when the temperature is high and the bulb is automatically turned on when the temperature is low, keeping the chickens cool or warm as needed.

3.1 fig: Temperature Management in the Smart Control Cage System (Fan ON)

4.1 fig: Temperature Management in the Smart Control Cage System (Bulb ON)

3. Water Management:

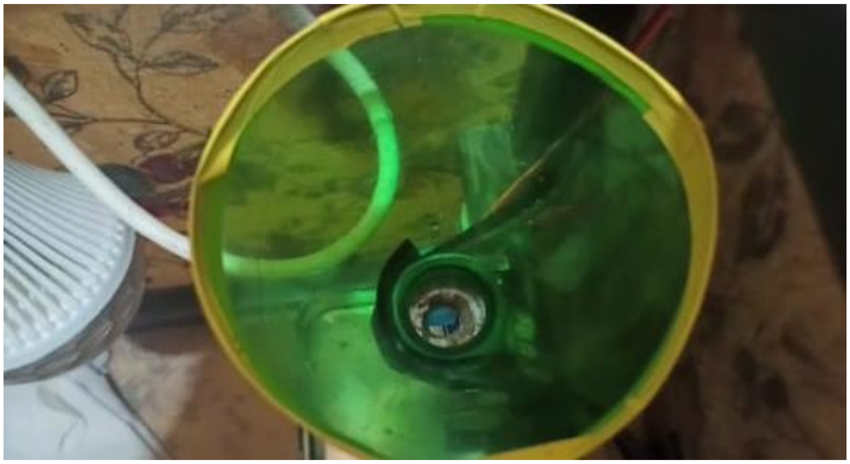
1. The water level sensor is used to monitor the water levels in the cage system, ensuring the chickens always have access to fresh and clean water.
2. The data from the sensor is used to control the water motor, which automatically refills the water supply when the water level decreases, guaranteeing the chickens never go thirsty.



5.1 fig: Water Management in the Smart Control Cage System

4. Feed Management:

1. The ultrasonic sensor is used to measure the level of feed in the feed box, ensuring the chickens never go hungry.
2. The data from the sensor is used to control the servo motor, which automatically opens the feed box and fills it with feed when the level is low, always providing the chickens with a bountiful feast.



6.1 fig: Innovative Feed Management in the Smart Control Cage System

5. Real-Time Look at Poultry Farming with LCD Display:

The Smart Control Cage System uses an LCD display to provide real-time data on the various aspects of the poultry farming process. The data displayed on the LCD screen includes:

1. Temperature and humidity levels in the cage system.
2. Water levels in the cage system.
3. Feed levels in the feed box.
4. Ammonia levels in the cage system.

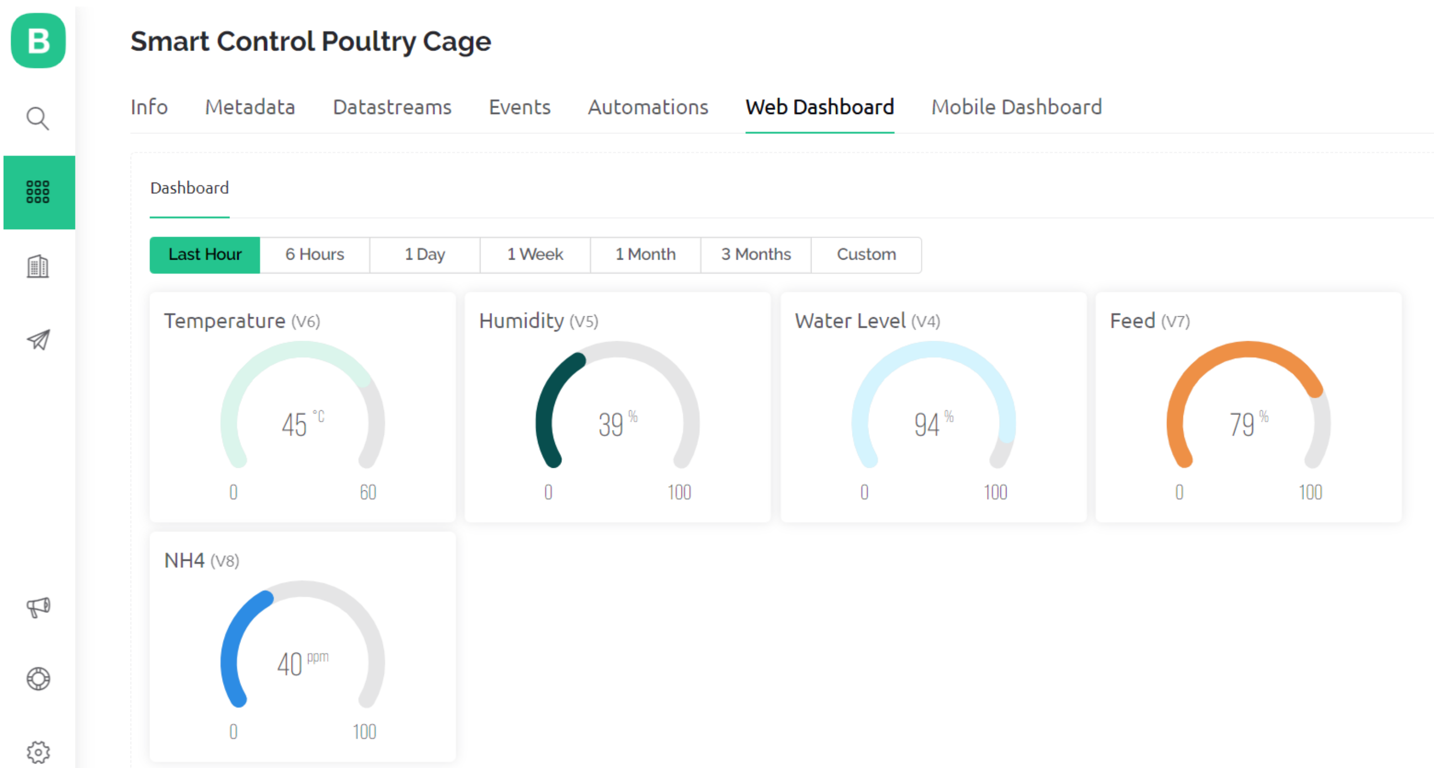
7.1 fig: The Smart Control Cage System with the LCD Display

The App Blueprint of the Smart Control Cage System:

The Arduino board sends the sensor data to the NodeMCU v3 (esp8266) device in the form of a string, which is then parsed by the NodeMCU v3 (esp8266) device to extract the individual values of temperature, humidity, water level, and feed level. These values are then sent to the Blynk app, where they are displayed in real-time on virtual pins V5, V6, V4, and V7 respectively.

The Blynk app allows the user to see the sensor data in real-time and provides the ability to set up notifications if the temperature, humidity, water level, or feed level goes above or below a certain threshold. This makes it easy to keep an eye on the conditions inside the cage and act if something is wrong.

In summary, the Nodemcu v3 (esp8266) device is used to connect the Smart Control Cage System to the Blynk app through Wi-Fi, and continuously sends the sensor data of temperature, humidity, water level and feed level to the app for real-time monitoring.



8.1 fig: App Blueprint of the Smart Control Cage System

Results and Discussion:

The Smart Control Cage System is a comprehensive solution for automating and optimizing various aspects of poultry farming. It uses a combination of sensors and control components to monitor and regulate key environmental factors such as temperature, humidity, water levels, feed levels, and ammonia levels in the cage system. The data collected by the sensors is transmitted to the Blynk app in real-time, allowing for remote monitoring and control of the system. This feature allows farmers to make quick adjustments to the system when necessary, ensuring optimal conditions for the poultry at all times.

The system is designed to be easy to set up and use, with the NodeMCU v3 (esp8266) device acting as the bridge between the sensor data and the Blynk app. The NodeMCU v3 (esp8266) device is connected to the Blynk app through Wi-Fi, and continuously sends sensor data to the app for real-time monitoring. The App Blueprint of the Smart Control Cage System provides a clear and concise overview of the app's functionality, making it easy to navigate and use.

One of the main benefits of the Smart Control Cage System is that it can help to improve the comfort and safety of the birds, by allowing farmers to monitor and control the temperature, humidity, and other conditions inside the cage. This can help to prevent heat stress and other conditions that can harm the birds, and ultimately improve the overall health and productivity of the flock. Additionally, the system can help to improve the efficiency of the farm by reducing the need for manual monitoring and control of the devices, which can save time and labor costs. By automating various aspects of the poultry farming process such as temperature regulation, feed management and monitoring the water levels, farmers can now focus on other important aspects of the farm, such as disease prevention, egg collection, and bird health.

However, it's also important to keep in mind some limitations of this system. For example, the Smart Control Cage System is dependent on stable internet connection and power supply, and in case of any power failure or internet connectivity issues, it will not be able to send data to the app. Additionally, the system requires initial setup, calibration, and maintenance for optimal performance. It could also be costly to install and maintain, depending on the number of sensors required to be installed.

In conclusion, the Smart Control Cage System is a powerful and flexible solution for remote monitoring and control of various aspects of a poultry farm. It allows farmers to improve the comfort and safety of their birds, as well as the efficiency of the farm, by providing real-time monitoring and control of temperature, humidity, water level and feed level. With the potential benefits, it's important to also keep the limitations in mind and weigh the costs and benefits before deciding to implement them. The system has the potential to revolutionize the poultry farming industry and make it more efficient, profitable, and sustainable.

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