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Smart Bird Habitation with Live Data Streaming Using Thing Speak

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ABSTRACT: So far the conventional cage of love birds is used in most of the bird farms. But often their health is not properly monitored and needs special attention at all stages of their growth. Some major factors affecting the health of love birds are temperature and humidity. The optimal temperature in a bird cage is 25 to 30 degree Celsius. The recommended air humidity is around 77 to 80%. The proposed design aims at automatic temperature control, feeding and cage cleaning. Here we use Arduino UNO as the decision-maker. Using a bulb and fan we can implement temperature regulation. Water in the feeder will get automatically refilled based on the values given by the sonar sensor. By using a timer circuit automatic cage cleaning can be implemented. The health updates of the birds will be streamed in the ThingSpeak channel using Wifi.

KEYWORDS: Arduino UNO [7], Love Birds[1], Wifi, ThingSpeak

I. INTRODUCTION

Birds are important members of many ecosystems. They play a vital role in controlling pests, acting as pollinators, and maintaining island ecology. In addition, birds are important to humans in many ways, such as serving as a source of food and providing fertilizer in agricultural settings. Birds are obviously important members of many ecosystems. They are integral parts of food chains and food webs. In a woodland ecosystem for example, some birds get their food mainly from plants.

The project extends our concern towards living organisms other than humans. Often demands of humans are endless and we fail to think about birds and animals around us. Over many years we have been using conventional bird cages. In case of birds who need extensive care we have to implement an efficient design. Smart bird cages can offer incubator-like care for these birds. The product is flexible in terms of cost as well. The cage can be customized for different varieties of birds.

Intelligent systems have become dramatically required in recent days. It intervenes in most aspects of our life, because it often makes our life easier and more manageable. Care Smart System for bird breeders is an interesting application in our life, it will reduce time and efforts spent by the bird breeders.

The use of colony cages is in great demand, and birds are healthier because they have enough space to move, not easily depressed, and easier food and drink provision. The disadvantage of this cage is, whenever it has an unhealthy bird, it will quickly spread to the others. In order to avoid disease dispersion, the bird's waste must regularly be checked inside the cage. To keep the cage in a healthy condition, we need to pay attention to the ideal temperature of the cage so that thlivestock proprocess runs smoothly.

Monitoring and controlling cleanliness, temperature, humidity, eating, drinking birds in a colony cage can be done automatically using the Smart Bird Cage implementation. The optimal temperature in a bird cage is 25 to 30 degree Celsius. The recommended air humidity is around 77 to 80%. The proposed design aims at automatic temperature control, feeding and cage cleaning.

Here we use Arduino UNO as the decision-maker. Using a bulb and fan we can implement temperature regulation. Water in the feeder will get automatically refilled based on the values given by the sonar sensor. By using a timer module automatic cage cleaning can be implemented. The health updates of the birds will be streamed in ThingSpeak channel.

II. LITERATURE SURVEY

The traditional design of the bird lovebird's cage has been implemented for many years. Typically, a healthy lovebird shows behaviors like actively whistling at any moment. Some factors are affecting the health of the lovebird, like temperature and humidity. In normal conditions, the temperature and humidity of the lovebird's cage should

continuously be in 25 0 C-30 0 C, with the humidity around 77% - 80%. In irregular cases, the temperature and humidity are increased significantly higher or lower than they should be. In this inconsistent situation, it is causing the lovebird's health in some problems like increasing or decreasing its appetite, inactive movement, and unnormal whistling behavior. The new lovebird's cage design has been implemented in order to improve the health's quality of the lovebird. It is complemented with a microcontroller Arduino as a controller of the lamp and fan in order to keep the temperature and humidity around the cage in constant value. It also integrated with the internet of things using things viewed in case of real-time monitoring using a smartphone. As A result, the new cage design shows the cage around is kept continuously normal. So, the breeding of the lovebird is significantly improved[1]

Temperature is an essential factor for stable performance of the positron emission tomography (PET). Some of the PET detector components produce significant heat (e.g. readout integrated circuits) that affects its performance. The temperature alters the breakdown voltage of photodetectors, which in turn affects the gain, cross talk, dark count rate and after-pulsing. One of the thermal regulation methods is to use an air/liquid cooling pipe embedded in a cold plate broadly distributing the temperature to the PC board; the gold vias in the board then conduct the temperature to the other side of the board. This paper concentrates on investigating the temperature distribution from various cooling structure configurations. The simulation software COMSOL was used with heat transfer and pipe flow modules to assess the thermal behavior of the cooling system. Two types of cooling pipe arrangements were simulated; a simple and a more complex curve arrangement. For the cold plates, a ceramic (92 W/m-K) and a thermally conductive plastic (10 W/m-K) were simulated. Full as well as "patchy" gold via configurations were also simulated. In summary, we have simulated various cooling pipe designs, cold plates and gold via distribution configurations to analyze the temperature variation across a PET detector PC board. The thermally conductive ceramic cold plate with as many vias as possible resulted in the most stable temperature variation[8]

The system designed in this paper is a smart cage system, which is used to take care of a dog when the owner lacks time. Smart dog cage has assisted dog owners to make their life easier and less concerned about their dogs when they are far away. In addition, This system has been developed for use in an animal hospital. Care for patients as well. Smart cage systems consist of an automatic cleaning excrement and urine which use image processing, automatic feeding, and dog monitoring. All of the modules are processed by a computer. Our system uses an IOS mobile application which is connected to the server for setting a parameter controlling a cage and monitoring a dog through an internet network[2] Today checking ecological parameters have increased more significance because of the expanding security and administrative consistency needs. So the estimation of such parameters turns out to be fundamentally imperative. To do the parameter estimation of remote places, the conventional wired frameworks fizzle. Subsequently there is a need for cutting edge innovation, for example, remote innovation. These days by and large we need to keep up, screen and examine temperature, weight, humidity. etc in nourishment and compound ventures. So we will give an IOT based answer to gather this information from different areas in the business, settle on a choice (control i/o's) and make investigations in light of that information. Such a remote framework will turn out to be helpful for agribusiness, human services, stockpiling ranges and so forth [4]

There is an increase in demand for low-cost Smart Switch Control Systems (SSCS) that can remotely control home switches or devices in residential environments using mobile applications or websites. In this paper, an SSCS which uses open source software, and can be configured without any physical adjustment to the environment, is developed to automatically minimize energy consumption. The device comprises two parts: An Android application and a unit made up of a programmable Arduino board, ESP8266 Wi-Fi module, wall socket and an SD card. In the SSCS, the Android application is used to remotely control switches using the Wi-Fi technology. Tests carried out on the system proved its effectiveness and quick response to signals[7]

As pet ownership is soaring each year, the demands for a higher quality of pet care products are increasing as well. This has driven the development of the Internet of Things (IoT) technology in this field. Using the technology of IoT, pet owners can remotely track their pet's activity and location, monitor their pet's health condition or even interact with their pets. All these smart pet care products are playing an indispensable role in the pet owner's daily life. In the present project, we apply the IoT technology to implement an integrated system including pet food feeder, water dispenser, and litter box, which are the three most fundamental elements that pet owners will be concerned about when they are busy or away from their pets. The three subsystems are connected to the local network with Arduino Uno boards and Wi-Fi modules. Furthermore, the data collected from each sensor are processed and displayed on a smartphone application. Thus, pet owners, through only one single interface, can obtain all the information regarding a pet's food consumption, water consumption, as well as defecation timing, duration, and frequency. Additionally, a

controlling function is also enabled in the application for the pet owners to dispense food anytime and anywhere. An overall statistical chart with the mentioned values is presented in the application, updating from time to time. With this pet care system in a smartphone application, we provide pet owners an efficient, convenient and low-cost tool for pet care[6]

Pets need special treatment and special care. Due to nowadays busy lifestyles, this task is not as simple as it used to be. The goal of this work is to introduce, design and implement a smart pet house. The objective is to allow pets' owners to automate simple things, like monitoring, lighting, feeding and air conditioning controls. Implementing smart pet houses will assure pets' owners an increased comfort and peace of mind especially when pets are unattended. Features included in the house are a monitoring system, a ventilation system, and an illumination system. The aim of introducing smart technology in the pet house is to achieve a more effective, efficient, comfortable, secure and smart pet management system. Various functions that serve the purpose of the work have been developed and a small prototype has been designed and implemented as a proof of concept[5]

IV. PROBLEM STATEMENT

The conventional colony cage system requires a lot of human intervention. A smooth and regular maintenance routine is needed for the healthy growth of sensitive birds. Maintaining the optimum temperature that suits their body often becomes a great challenge. Many traditional methods of using wet covering often fail. Moreover, maintaining a clean environment for birds is necessary to keep them away from scale diseases and fungal attacks. A system that keeps a track on the feeding rhythm of birds and also the temperature in the cage is the need of the hour.

The system uses Arduino as controllers for monitoring. Arduino is used to control the temperature of a proper enclosure, if the temperature exceeds the maximum limit it will turn on the electric fan and turn off, so the temperature is appropriately maintained. Timer circuit and relay controls the motor and brush in cleaning the dirt found on the base of the cage. The motor will rotate the brush in a circular manner. In order to avoid infection and maintain a dry atmosphere, simple brushing is preferred over wetcleaning.

ThingSpeak live streams the humidity and temperature in the birdcage. The owner can use it to monitor the condition of the

temperature and humidity contained in the enclosure through an internet connection, and ensure the condition of the colony enclosure is safe and the automatic device works properly.

IV. METHODOLOGY

Temperature regulation is carried out by turning on the fan and lamp as per the input given by the DHT11 sensor. Water will automatically be refilled in the feeding tank based on the input given by the sonar sensor. The timer circuit is the core element in the automatic cage cleaning system. Health updates of the birds will be streamed in the ThingSpeak that can be monitored by the owner.

Initially the digital temperature and humidity sensor DHT11 is turned ON. The sensor reads the temperature value in digital format. If the temperature is within the allowable range then the lamp and fan will be in OFF state and the algorithm demands to check the temperature once again. If the sensed temperature is not within the permissible range then the temperature regulation mechanism will start. Temperature regulation mainly depends on the decision made by the arduino. If the temperature has gone above the upper threshold then the arduino runs the algorithm to turn on the fan. And if the temperature has gone below the threshold then the arduino will run the algorithm to turn on the lamp. At a time only one of the regulation equipment will be turned ON. After a set period of time the algorithm will be restarted from the temperature checking step onwards.

The ultrasonic sensor will be turned ON. It will sense the water level. If it is within the limit then once again check the water level. If the water level needs to be controlled then the refilling mechanism will start. The ultimate decision maker in this case is the arduino. If the water level is below the lower threshold then the submersible water pump will be turned on. After a set time the water level is checked and if it is in the allowable limit then the pump will be turned off. If the water level has exceeded the upper threshold then also the pump will be turned off

A. ArduinoUNO

The Arduino Uno is an open-source microcontroller. Arduino developed UNO and it is a board based on the Microchip ATmega328P microcontroller. The board is provided with sets of analog and digital input/output (I/O) pins that may be interfaced to other circuits and various expansion boards (shields). The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins. It is programmable with the Arduino IDE (Integrated Development Environment), through a type B USB cable. It can be powered by an external 9-volt battery or by the USB cable. Its working voltage is between 7 and 20volts.

B. NodeMCU Wi-Fi Module –ESP8266

The ESP8266 Wi-Fi Module is an SOC with integrated TCP/IP protocol stack that can provide any microcontroller access to your Wi-Fi network. The ESP8266 is able to host an application or offload all Wi-Fi networking functions from another application processor. NodeMCU is a low-cost open source IoT platform.[4][5] It initially included firmware which runs on the ESP8266 Wi-Fi

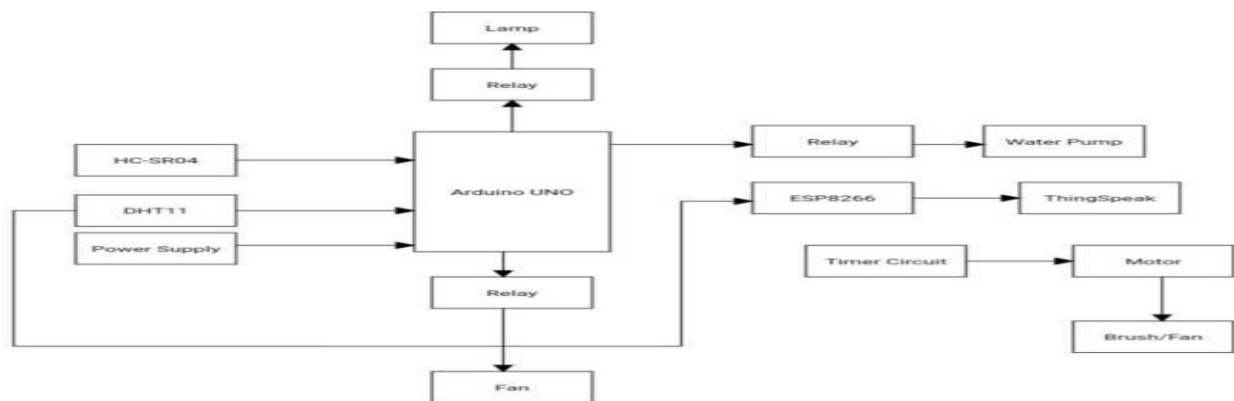


Fig 1: Block Diagram

SoC from Espressif Systems, and hardware which was based on the ESP-12 module.[6][7] Later, support for the ESP32 32-bit MCU was added. NodeMCU is an open source firmware for which open source prototyping board designs are available.

The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated developmentkits.

C. DHT11Sensor

It is a digital temperature and humidity sensor. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc... to measure humidity and temperature instantaneously. It consists of a capacitive humidity sensing element and a thermistor for sensing temperature. DHT11 humidity and temperature sensor is available as a sensor and as a module.

D. HC-SR04 SonarSensor

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It uses non-contact ultrasound sonar to measure the distance to an object, and consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit. Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required.



E. TimerCircuit

A circuit that synchronizes or activates something by means of a repetitive timing signal; specifically one that sets a circuit or device, especially a CPU, to run at a particular rate.

The system regulates temperature by turning ON the lamp if temperature falls below the allowable range and turns ON the fan if the temperature goes above the range. The pump will be turned on once the water level goes beyond the upper threshold value (the max distance of water surface from the top of the feeder). The brush for cleaning the cage will be turned on for the set OP time and turned off for the set CL time. This cycle of cleaning can be repeated by setting the LOP option in the timer module. The temperature and humidity data can be viewed on the created ThingSpeak channel.

Here, arduino plays the role of decision maker. First of all it will check if the temperature is within the optimum range. If yes then the sensor continues to sense the temperature. If not then arduino will pass commands to either lamp or fan. If the temperature is below 25oC then the lamp will be turned on and if the temperature reads above 30oC, then the fan will be turned on. Once the temperature is under control then both lamp and fan will be turned off and the DHT11 sensor reads the temperature

Automatic water refilling module starts when the trigger pin of the HC-SR04 sensor is set HIGH for 10µs. In response, the sensor transmits an ultrasonic burst of eight pulses at 40 kHz. These eight ultrasonic pulses travel through the air away from the transmitter. Meanwhile the echo pin goes HIGH to initiate the echo-back signal. If those pulses are reflected back, the echo pin goes low as soon as the signal is received.

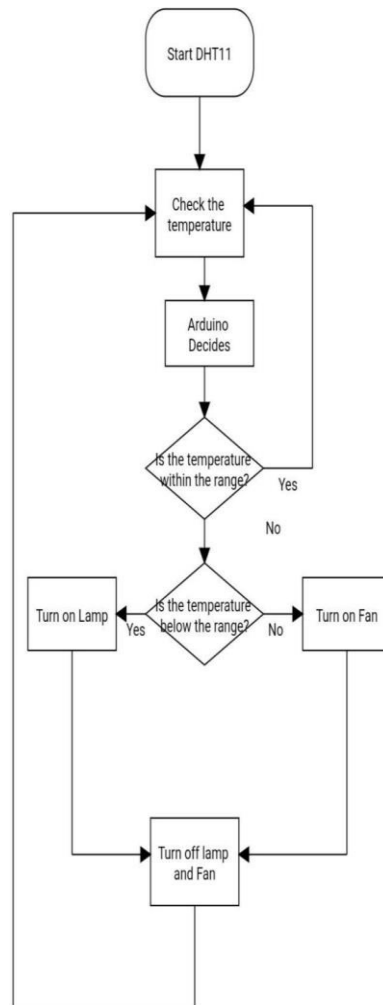
The pulseIn function helps to determine the duration for which echo pin stays high. This will give the duration.

$$\text{Distance} = (\text{Duration} \times 0.034) / 2$$

Speed of sound in air is 0.034 cm/µ sec

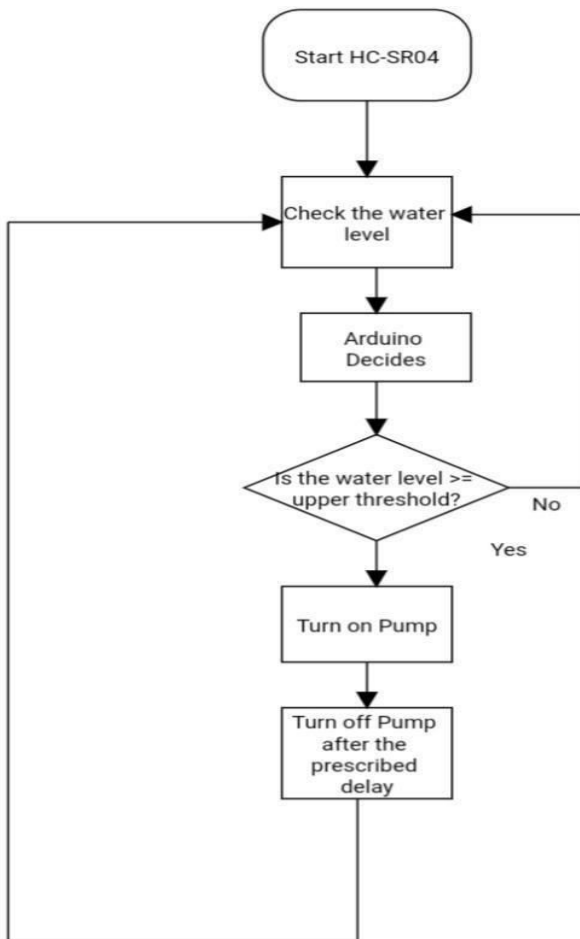
This distance will be calculated and passed to Arduino UNO.

If the water level is less than a threshold range, then the pump will not be turned on and the sensor continues to take values. If the water level is greater than or equal to the threshold range then the pump will be ON and water will be refilled.



V. IMPLEMENTATION

Fig 3: Automatic Water Refilling



A. Temperature Regulation

The temperature regulation segment is contributed by the DHT11 sensor module, Arduino UNO, one terminal block of the 4 channel relay, bulb and fan. The Vcc and GND pins of DHT11 are connected to the 5V and GND pins of Arduino UNO respectively.

The data pin of DHT11 is connected to the digital pin 4 of Arduino UNO. The relay input to activate the lamp (IN 3) is connected to the digital pin 7 of arduino. The relay input to activate the fan (IN 2) is connected to the digital pin 9 of the arduino. Basically in the system we have used 2 Arduino UNO. One for temperature regulation and the other for automatic water refilling. The 4 channel is shared among the 2 arduinos. This is done by shorting the GND of 2 arduinos and connecting the Vcc and GND of 4 channel relay to the 5V and GND of any one of the arduinos.

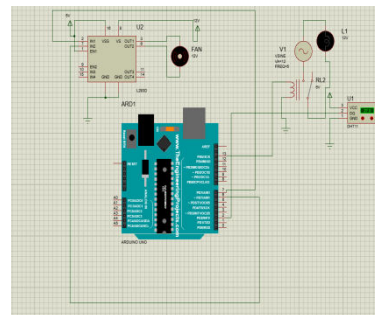


Fig 4: Automatic Temperature Regulation

B. Automatic CageCleaning

The automatic cage cleaning segment consists of 6-30 V 1 Channel Power Relay Module with Adjustable Timing Cycle, motor and brush. The motor is connected to the relay end of the module (NO & COM).

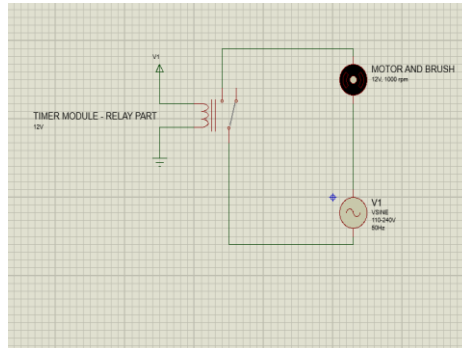


Fig 6: Automatic Cage Cleaning

C. DataStreaming

The data streaming segment is constituted by Node MCU ESP8266 and DHT11. The Vcc and GND pins of DHT11 are connected to the 3.3V and GND pins of Arduino UNO respectively. The data pin of DHT11 is connected to the GPIO 0 of Node MCU.

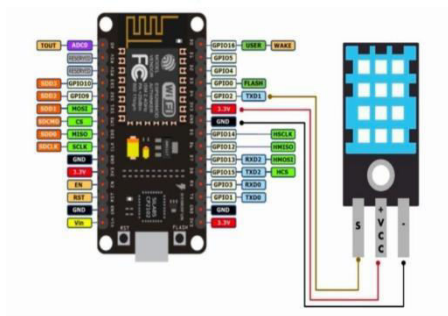


Fig 7: Data Streaming

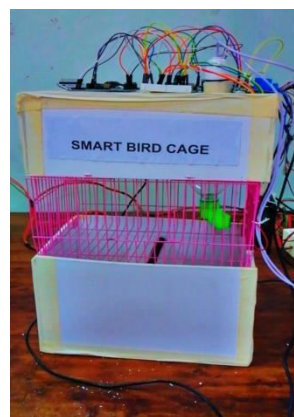


Fig 8: Prototype

VI. RESULT

Initially we prepared the schematics of the circuits using Proteus and Tinkercad. The codes were compiled in Arduino IDE. Sensor readings were observed using a serial monitor. The smart bird cage with automatic temperature

regulation, automatic water refilling and automatic cage cleaning was implemented. Through Thingspeak the owner got real time updates about the temperature in the cage.

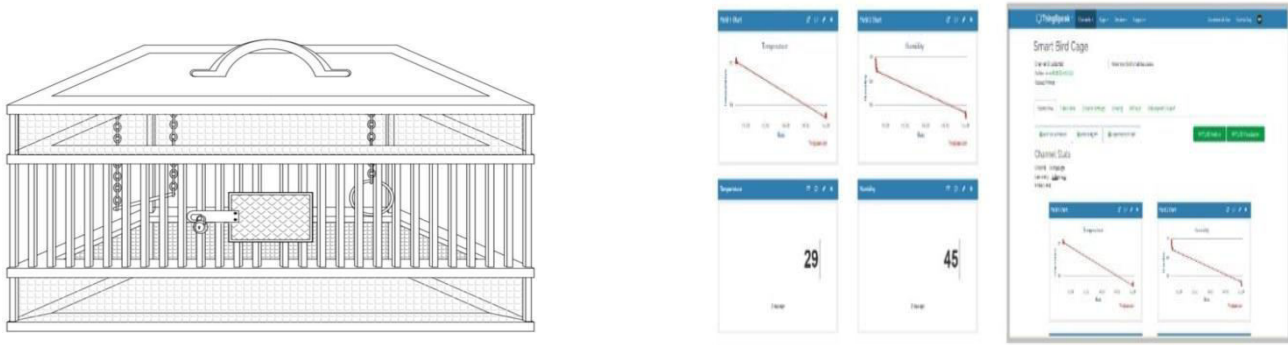


Fig 9: ThingSpeak channel output and 3D image of the system

A. Merits and Demerits

Proposed design is highly modular. Thus, customers can choose the functions of the bird cage. The current system focuses on delivering an optimum condition for love birds but the same can be extended to many other birds by simply changing the threshold. Usually water refilling in the feeder, cage cleaning and temperature regulation need enormous human effort. But the proposed system reduces all these efforts through automated implementation. Live data streaming of the temperature information using an IoT analytics platform service will put the cherry on top of the cake.

Apart from all the merits the system holds some demerits. Automatic temperature regulation and water refilling sections require simultaneous monitoring. Thus, working on a single Arduino UNO makes it difficult. Due to the use of lamp and motors, the proposed system isn't a standalone one. Poor WiFi connectivity can hinder the live data streaming on ThingSpeak.

VII. CONCLUSION

Our project aims at maintaining an optimum temperature and humidity. It comes up with an automatic water refilling system and automatic cleaning system. Moreover, ThingSpeak displays the bird's health status. The proposed system can give new direction in aviculture.

The results of research and testing that have been carried out, it can be concluded that:

1. The temperature and humidity displayed on a website through an internet connection can function appropriately in realtime.
2. The relay can turn on the heating lamp when the temperature is below the minimum limit that has been determined, which is 25 0 C, and can turn on the electric fan if the temperature exceeds the maximum limit of 300 C automatically, so the temperature can be maintained under safe boundary conditions.
3. When cleaning bird droppings in the cage base, the tool can turn on the motor to move the brush for a specified time interval.

VIII. FUTURE SCOPE

1. Test Animal Care Unit: A temperature regulation unit can maintain optimum temperature around sensitive animals
2. HabitHub: An Alexa and Arduino smart home for pets
3. IoT Treat Dispenser for pets
4. Low cost portable incubator



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