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Temperature and Humidity Monitoring for Sericulture

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Abstract: Sericulture refers to the raising silkworms to deliver silk. India is the second biggest producer of silk in delivering 15% of the aggregate silk creation. Sericulture is the base of social, economic, cultural and political progress of India. Temperature and humidity play a main role in the development of healthy silkworms in every stage. Disinfection is one of the reproving parameters to be considered for healthy and successful silkworm rearing. Sericulture is the significant occupation in India and techniques utilized by the agriculturists are as yet outdated. Hence there exists the need of using innovation in Sericulture cultivate. Although, there are different modules available for temperature and humidity tracking. No systems are actually implemented for sericulture domain for monitoring purpose. The temperature is controlled and monitored for eggs, termed as incubation. But there are no noticeable methods for further stages of silkworm. Therefore, it emphasises the need of automatic and continuous monitoring for Sericulture. The main focus here is providing a way of monitoring automatically and continuously without frequent human intervention by combining the traditional methods. To achieve this model, we made use of technologies like IoT and cloud that provides several capabilities for the model like real time data storage, alerts for user also providing various kind of visualisation to know about the current and previous environmental condition in silkworm shed remotely. Thereby reducing the risk of silkworm infection due to varying environmental condition.

Keywords: Temperature, Humidity, IoT (Internet of Things), Automation, Arduino, Cloud (ThingSpeak).

I. INTRODUCTION

Sericulture denotes to the rearing of silkworm to produce silk. Parameters like Temperature, Humidity and Light intensity are the important factors in the progression of silkworms and suitable encouraging must to be done according to the requisites in every stage. Environmental variations are the important part in the growth and development of silkworm. Sericulture is one of the prominent occupations in India and the techniques used by the agriculturists are yet outdated. Hereafter there is the need of developing modernization in sericulture. This endeavour gives a thought of providing automation in sericulture. The model goals at making use of developing technology that is IOT and smart Sericulture using automation. The prototype has the scope in different areas like poultry farming, mushroom farming.

Compared to existing scenario there are different modules available for temperature and humidity tracking. No systems are actually implemented for sericulture domain for monitoring purpose. The temperature is controlled and monitored for eggs, termed as incubation. But there are no noticeable methods for further stages of silkworm. Therefore, the current proposed project includes IOT based dedicated temperature and humidity monitoring for sericulture while providing alerts for the users when the range exceeds.

The proposed system will include Testing and Validation of sensor. Receiving signal with the help of Internet of Things (IoT). Interfacing sensors to microcontroller to achieve the desired result. Based on sensor signal analysis it provides the appropriate control signal to meet required condition. Tools used: Arduino uno micro controller board, Temperature and humidity sensor: DHT11 humidity range:20-95% and temperature range:0- 50-degree Celsius. OLED display for integrating on the board, Arduino IDE for programming purpose and an ESP8266 model to provide internet connectivity. The model is able to, switch ON the heating devices when temperature < 27 or humidity > 80% similarly switch ON the humidifying devices when the temperature > 30 or humidity < 60%. Provides the visualisation in the form of graph, digital and gauge format. With the above functionality the prototype will also produce mail alert using webhook API to the user when the range exceeds.

II. EXISTING AND PROPOSED SYSTEM

Proposed system: To provides automatic way of continuously monitoring the temperature and humidity in sericulture based on IoT.

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Existing system: It works in a manual by using traditional methods that needs frequent human intervention.
Need of proposed system: Although there are incubations for very early stages of silkworms but there are no specific (recommended) ways for further stages, to overcome this issue the proposed system would serve well.

III. TOOLS AND TECHNOLOGIES

IoT: The Internet of Things (IoT) describes the network of physical objects "things" that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.
Over the past few years, IoT has become one of the most important technologies of the 21st century. Everyday devices can be connected to the internet via embedded devices, seamless communication is possible between people, processes, and things.
By means of low-cost computing, the cloud, big data, analytics, and mobile technologies, physical things can share and collect data with minimal human intervention. In this hyperconnected world, digital systems can record, monitor, and adjust each interaction between connected things. The physical world meets the digital world and they cooperate.

Arduino IDE: The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

ThingSpeak: ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyse live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualization of live data, and send alerts.

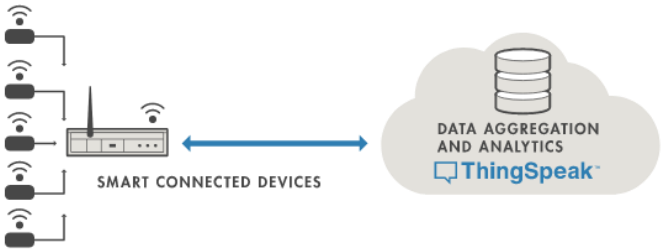

Fig 1: ThingSpeak cloud

IFTTT: IFTTT derives its name from the programming conditional statement "if this, then that." What the company provides is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.

Webhook: The Webhooks service allows you to integrate other services on IFTTT with your projects via simple web requests. The Webhooks service uses real-time triggers, so Webhooks Applets normally run within a few seconds.

IV. WORKFLOW

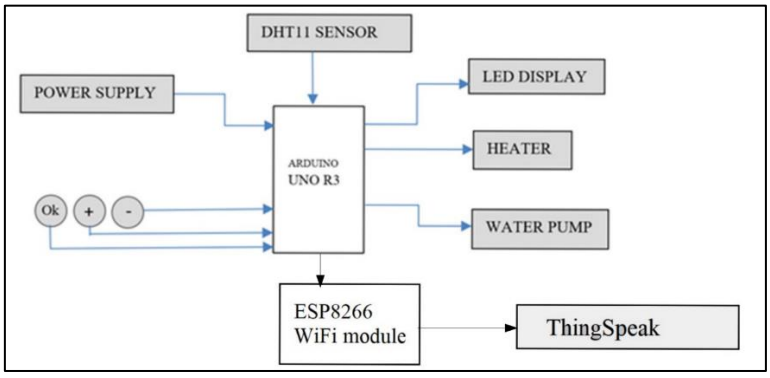

Fig 2: Architectural design

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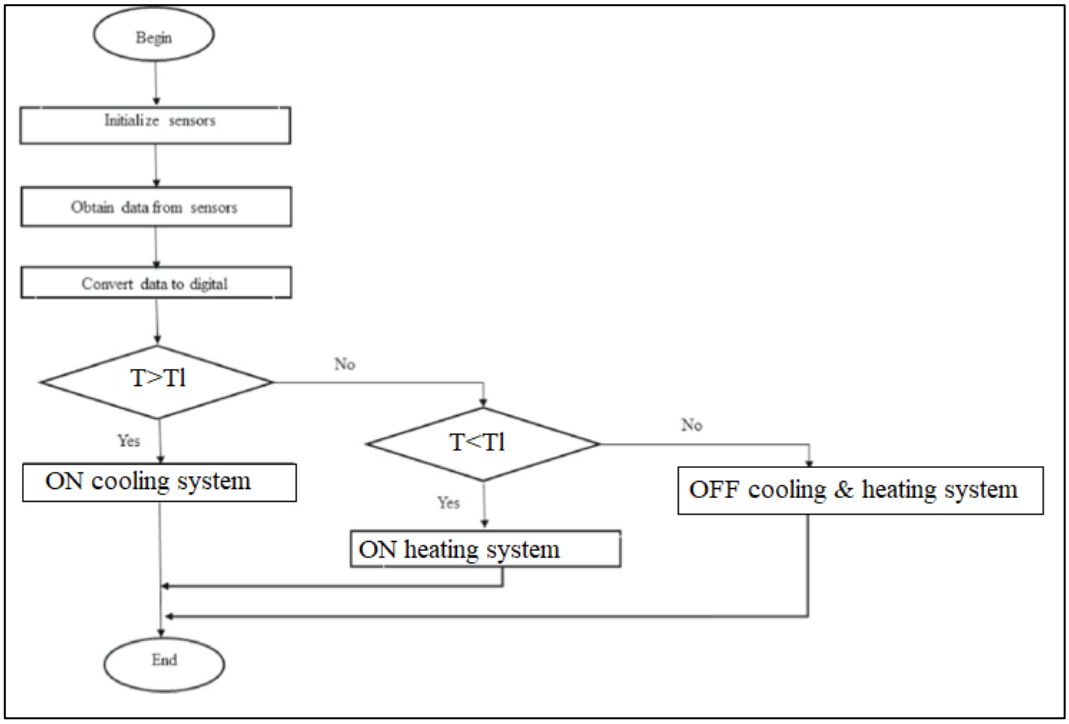

Fig 3: Flow chart

Module Description:

1.Sensing Module: As shown in fig 3 DHT11 is the sensor that can sense both temperature and humidity.

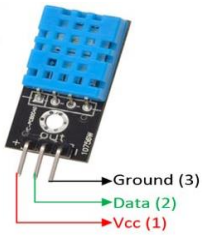

Fig 4: DHT11

Specification: Temperature range: 0^0 C - 50^0 C, Humidity range: 20% - 95%, Voltage: 3.3 volts.
Input: Surrounding environmental condition (temperature and humidity in sericulture shed).
Process**:** The moisture holding substrate between the electrodes which absorbs the moisture in the surrounding. The pin number to which its connected and the type is specified in the coding and fed to Arduino in order to receive the data from the sensor.
Output: Analog output of current temperature and humidity.

2.Display Module: OLED display, the acronym 'OLED' stands for Organic Light-Emitting Diode, a technology that uses LEDs in which the light is produced by organic molecules.
OLED displays are made by placing a series of organic thin films between two conductors. When an electrical current is applied, a bright light is emitted.

Fig 5: OLED Display

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Specifications: VCC: 3.3 volts 5 Volts, GND (Ground), SCL (Serial Clock), SDA (Serial Data).
Input: The input is the sensed data from sensing module.
Process: When the input voltage is supplied the OLED diode produces the light.
Text size, colour, position (in x, y co-ordinates) and font is set to data to be displayed. Using display.begin( ) the display is initialised.
Output: Displaying current temperature and humidity data on the screen using display.println( ).
3.ESP Module: ESP8266 is a Wi-Fi microchip, with built-in TCP/IP networking software, and microcontroller capability.

Fig 6: ESP8266

Specification: Power: 3.3V, Digital I/O Pins (DIO): 16, Analog Input Pins (ADC): 1, Flash Memory: 4 MB, SRAM: 64 KB.
Input: Real time data from the sensing module.
Process: Connects to the internet using http client and server calls the data is passed to the ThingSpeak cloud.
Output: Real time data storage in the cloud and alert provisioning.
4.Relay Module: A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.

Fig 7: Relay

Specification: Supply voltage – 3.75V to 6V, Trigger current – 5mA, Relay maximum contact voltage – 250VAC, 30VDC, Relay maximum current – 10A.
Input: Signal LOW or HIGH is the input to relay.
Process: In this case, active LOW relay is used. Therefore, LOW signal activates the relay, HIGH signal inactivates the relay. Same process happens in both the channels.
Output: Switching ON or OFF devices corresponding to the signals.

V. OUTCOME

Table I represents the test done and its outcome expected outcome with actual output to test correctness of each module individually.
Table I: Test Cases for Each Modules

Test case id	Test case description	Sample input	Expected output	Actual output	Result
1	DHT 11 temperature sensing	Surrounding environment	Current temperature	Current temperature	Pass
				Any other output	Fail
2	DHT 11 humidity sensing	Surrounding environment	Current humidity	Current humidity	Pass
				Any other output	Fail

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3	Relay Testing	LOW signal	Activate devices	Activate devices	Pass
				Any other output	Fail
		HIGH signal	Deactivate devices	Deactivate Devices	Pass
				Any other output	Fail
4	Check network connectivity, ESP8266 wi-fi module	Provisioning internet	Getting connected to the internet	Getting connected to the internet	Pass
				Any other output	Fail
5	Display OLED	Data to display	Display data in specified format	Display data in specified format	Pass
				Any other output	Fail
6	Alert when range exceeds	Temperature and humidity data	Send alert mail to user	Send alert mail to user	Pass
				Any other output	Fail

VI. CONCLUSION

In this study, the need for an Automatic Monitoring System for Sericulture is addressed and developing this project helped us to gain some experience in real time development. Hereby we conclude that the model will surely be a valuable proposition in contrast to the changing user requirements. Each of the activities designed in this project have independent functionality. We can add other modules as and when needed. Every attempt has been made to ensure that the application is fully functional and works effectively and efficiently.

The model has been tested with all possible data to cover all possible options and checked for all outputs. Since the model is flexible and modular, further modification of the same can be easily incorporated.

The concluded results are,

Accepting temperature, humidity and display the same.

Actions according to range specified:

Temperature range: 27-30 degree Celsius

Humidity range: 60-80% RH

ON heater when temperature is below the range or humidity above the range.

ON cooler when temperature is higher the range or humidity below the range.

Upload the real-time data to the cloud.

Provide visualization of every data that is stored.

Alert provisioning when the range exceeds.

VII. FUTURE ENHANCEMENT

The model can be further enhanced by adding functionalities like,

Remote operation by user.

Providing temperature and humidity range explicitly.

Model is automated using IoT for temperature and humidity monitoring, by integrating other technologies like image processing the sericulture monitoring can be improved that helps in monitoring health of silkworm also.

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