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Sericulture Automation System Climate Control And Production Efficiency

B. Sandeep Kumar[1], P. Vyshnavi[2], Sana[3], Y. Rahul Kumar[4], N. Pranay[5]

Assistant Professor, Dept. of Electronics & Communication Engg,

Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India[1]

UG Students, Dept. of Electronics & Communication Engg,

Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India[2-5]

Abstract: 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. Sericulture is the process of nurturing silkworm to produce silk. Many biotic and abiotic factors are responsible for growth and development of silkworm and successful crop harvest. Modernization with introduction of new technologies is the only alternative to mitigate the limitations of traditional labour intensive sericulture practices and to enhance silk production. Artificial intelligence with IoT will benefit the progress of silkworm and host plant sector by maintaining temperature, humidity and other related factors. Remote sensing technique is arising as a suitable tool for identification of favourable sites for plantation. Environmental variations assume as the important part in the growth and development of silkworm. Sericulture is the important occupation in India and the techniques used by the agriculturists are yet outdated. Hereafter there is the need of developing modernization in sericulture cultivate. This endeavor gives a thought of providing automation in sericulture cultivate. The model goals at making use of developing technology that is IOT and smart Sericulture using automation

Keywords: Nodemcu ESP8266 Microcontroller, Relay, DHT11 sensor, Fan, Bulb, Water pump.

I. INTRODUCTION

A sericulture automation system refers to the use of modern technologies—such as sensors, IoT (Internet of Things), AI (Artificial Intelligence), image processing, and automated actuation—to monitor, regulate, and optimize the process of silk-worm rearing and related activities. Traditionally, sericulture depends heavily on manual labor and human judgment to maintain environmental factors like temperature, humidity, light, air quality, feeding schedules, disease control, and mulberry plant maintenance. An automated system aims to ensure these factors are kept within ideal ranges throughout the various stages of silkworm development, thus improving yield, quality of cocoons, and reducing losses due to disease or environmental stress. Sericulture is the scientific practice of silk production through the rearing of silkworms. Silk, often referred to as the "queen of textiles," is highly valued for its natural sheen, softness, durability, and tensile strength. The process of silk production is intricate and requires careful management at every stage. Silkworms, one of the most significant domesticated insects, spin high-quality silk threads in the form of cocoons while feeding on mulberry leaves during their larval stage. Environmental factors, including temperature and humidity, play a crucial role in determining the yield and quality of silk. Variations in these conditions, both daily and seasonally.

II. LITERATURE SURVEY

Automated Smart Sericulture System based on 6LoWPAN and Image Processing Technique" Sericulture is the process of growing silkworms for the purpose of producing silk. India is the world's second-largest silk producer. Sericulture is at the heart of India's social, economic, cultural, and political development. Temperature and humidity play a critical role in the growth of healthy silkworms at all stages, particularly during larval development. Disinfection is one of the most important factors to consider when raising healthy and successful silkworms. Sericulture is an important occupation in India, but outdated techniques are still used. This project aims to introduce automation in sericulture by utilizing lot and smart sericulture systems. It involves monitoring temperature, humidity, and light intensity using sensors and sending notifications

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to the user's mobile application. The research paper highlights the importance of sericulture in India, the need for automation in silk production, and the application of lot and data analytics for monitoring and improving sericulture. It suggests using lot sensors, an Oracle database, and Tableau for data analysis and visualization. „Intelligent Control System for Sericulture‘. Sericulture (the manufacture of silk) is an important rural occupation. India is the world's second largest silk producer, accounting for around 15% range, of global production after China, which accounts for a staggering 80%. An examination of Indian sericulture processes reveals a significant need for automation, particularly during the pre-cocoon stages. During this phase, the silkworms go through critical bodily changes that impact the quality and amount of the silk produced. It recommends a low cost and efficient wireless sensor network with IoT technology to monitor and control the temperature humidity.

III. SYSTEM ARCHITECTURE

The system consists of three main parts:

1. **Sensing Unit** – Collects environmental data using sensors
2. **Control Unit** – Microcontroller processes the sensor data
3. **Actuation Unit** – Controls devices like fans, heaters, and humidifiers

The sensors continuously send environmental data to the microcontroller. The microcontroller compares the values with predefined thresholds and activates control devices accordingly.

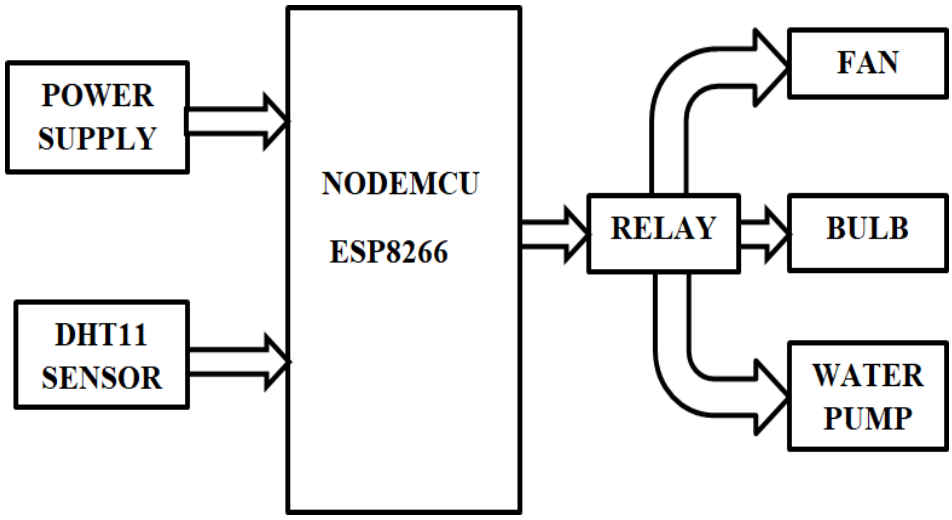

Figure 1: Block Diagram

IV. METHODOLOGY

System Overview: The proposed system automates climate control in a silkworm rearing environment to maintain optimal conditions for growth and silk production.

Data Sensing: Environmental parameters such as temperature and humidity are measured using the DHT11 Sensor.
Data Processing: The collected sensor data is sent to the microcontroller for analysis and decision making.
Control Unit: A microcontroller such as Arduino Uno or NodeMCU acts as the central controller of the system.
Threshold Comparison: The controller compares the sensor values with predefined environmental limits required for silkworm growth.
Temperature Control: If the temperature exceeds the set limit, the system activates a fan through a relay module to reduce heat.
Humidity Control: If humidity decreases below the required level, a humidifier or water pump is automatically activated.

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Continuous Monitoring: The system continuously monitors environmental conditions and adjusts devices automatically. **Data Display and Monitoring:** Environmental data can be displayed on an LCD screen and monitored remotely using IoT technology.

Efficiency Improvement: The automated system maintains stable environmental conditions, improving silkworm health and increasing silk production efficiency.

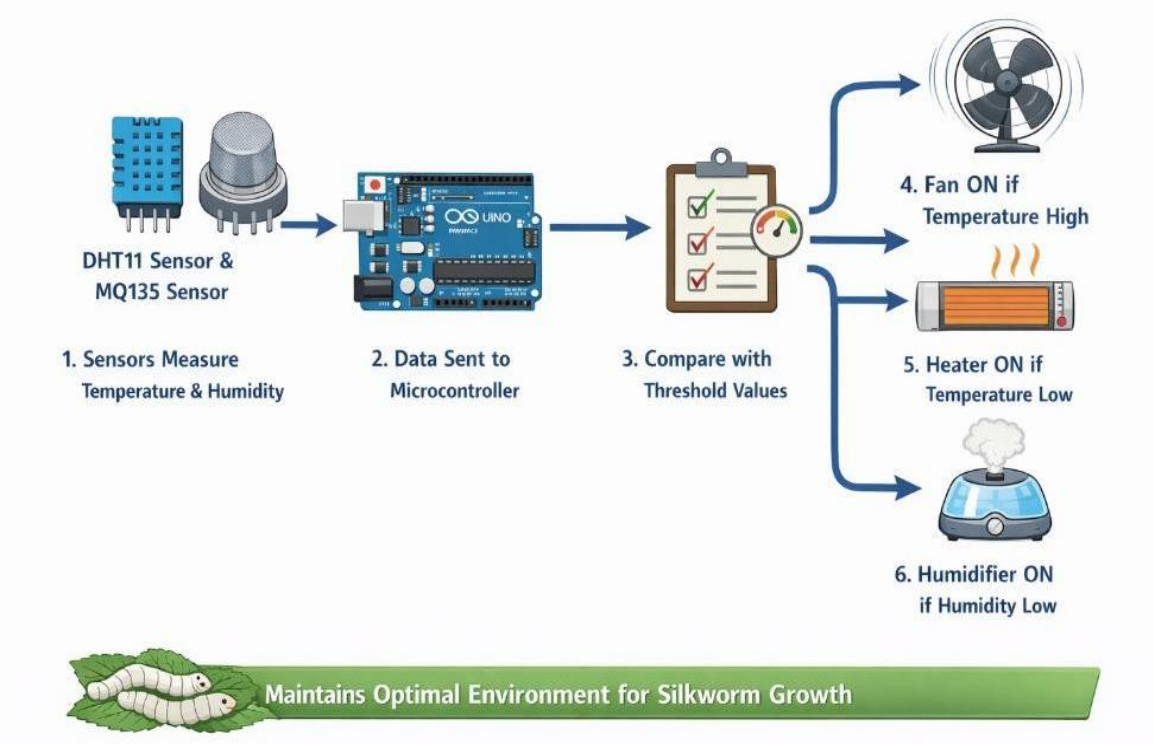

Figure 2: Automated Environmental Monitoring System for Silkworm Rearing WORKING PRINCIPLE (FLOW CHART)

1. **Start**

The system begins.

2. **Power in**

The powered on.

3. **Check: Able to read DHT11?**

The system tries to read temperature (and possibly humidity) from the DHT11 sensor.

- If No (i.e. reading fails), it loops back (retry).
- If Yes, proceed to the next step.

4. **Decision "Heat ≥ 30?" (in the chart "Heat 30?")**

It checks if the measured temperature is 30 °C or more (i.e. "is it too hot?").

- If No (i.e. temperature less than 30 °C), then Fan ON (turn the fan on).
- If Yes (i.e. at least 30 °C), Fan OFF (turn the fan off).

5. **Decision "Cool ≥ 25?" (in the chart "Cool 25?")**

After handling the fan, it checks if the temperature is 25 °C or more (i.e. "is it warm enough to keep LED off?").

- If No (i.e. less than 25 °C), LED ON (turn LED on).
- If Yes (i.e. ≥ 25 °C), LED OFF.

6. **Transmit Data**

After controlling fan and LED, the system sends out (or logs) the sensed data (temperature, humidity, maybe states of fan/LED)..

7. **Stop**

The loop ends (or possibly restarts, depending on how it's implemented**).**

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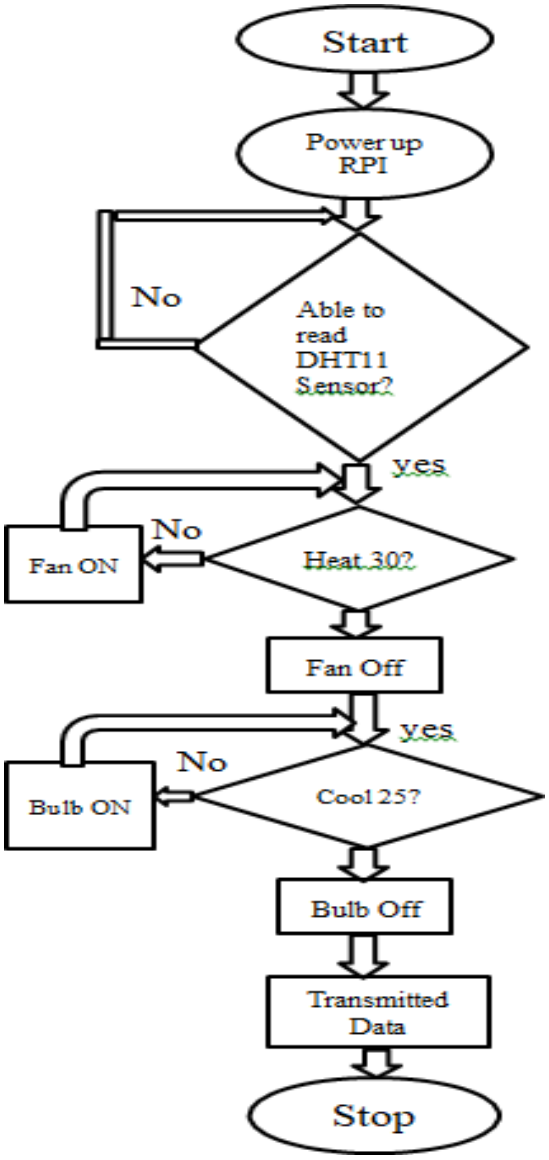

Figure 3: Flow chart

V. RESULTS

The sericulture automation system for climate control and production efficiency was successfully developed and operated as intended. In the proposed system, there is an analyzing of the execution parameters of Silkworm rearing house such as temperature, humidity and light intensity using IoT. The variation in the parameters such as temperature and humidity of silk worm rearing house is sensed by the sensor. In case if the temperature increases then the fan will be turned on and if it decreases the heater will be turned on, if light intensity is low then light will on. Recent advancements in sericulture automation have demonstrated significant improvements in productivity, efficiency, and sustainability. For instance, a multi-sensor system employing image processing and support vector machines achieved a cocoon classification rate of approximately 5.5 cocoons per minute, equating to about 2,640 cocoons in an 8-hour shift. The system attained an accuracy ranging from 86.48% to 93.54%, depending on the silkworm breed, showcasing its potential to enhance grainage center operations by reducing human error and labor costs.

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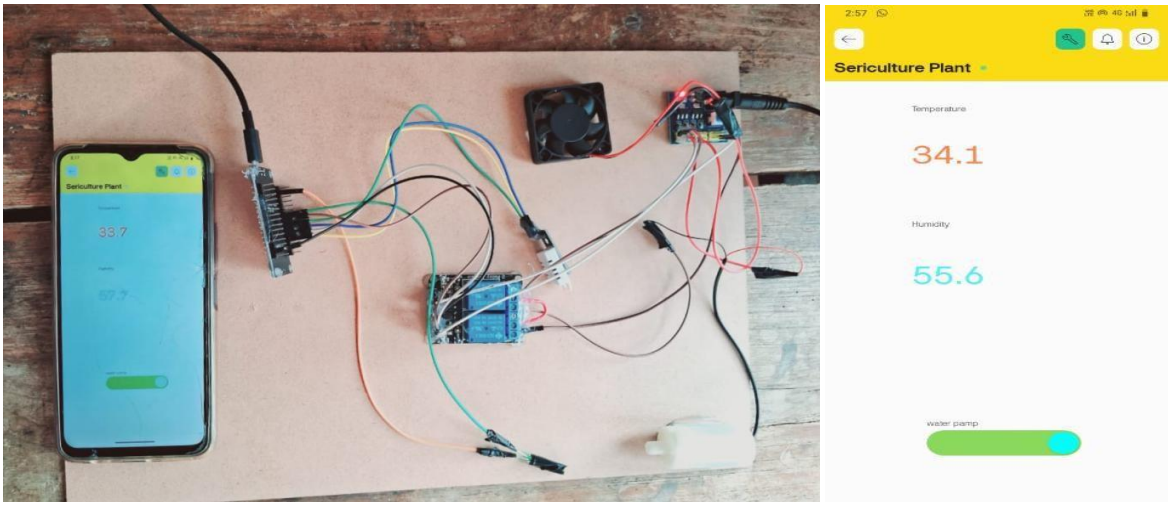

VI. CONCLUSION

The IoT-based sericulture automation system, modern technology such as artificial intelligence and internet of things could stimulate the development of sericulture and expected to reduce the challenges of the rearers, reelers and those who are involved in the venture. Successful installation of the technologies will surely prevent losses due to fluctuation of environmental factors. Operations related to field activities such as choice of soil for plantation and weather forecasting, diseases, pests will also be made easy.

Automation systems in sericulture—using tools like sensors (for temperature, humidity, gases), actuators, monitoring modules (IoT), image processing, AI/ML for disease/damage detection, robotics for feeding, and environmental control—are presenting a transformative opportunity for the silk-industry. These systems increase precision and consistency in critical parameters (temperature, humidity, feeding schedules), which are essential for healthy silkworm growth and high-quality cocoon production.

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