International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

Smart Sericulture System using Image Processing

Baddula Lakshith Reddy
B.E Information Science and Engineering,
Vemana Institute of Technology,
Bengaluru, India

Manjunath Bhaskar
B.E Information Science and Engineering,
Vemana Institute of Technology,
Bengaluru, India

***Abstract*— In recent times due to dynamic and vast variations in environmental conditions over the seasons, they have impacted the overall health of silkworms leading to genetic altercations and embryonic developments leading to a reduction in the quality along with the quantity of the silk being produced according to a recent survey.**

Through our project we have enabled an automated monitoring of temperature, humidity, harmful gases and through image processing we were able to detect worms that are diseased. Later we use an automated medicine sprayer to help the diseased worms become healthy. All this is being controlled over Arduino UNO.

Keywords: Sensors, Sericulture, Image Processing, IOT

I. INTRODUCTION

In a generation of the digital revolution, we stand at a place where everything we see and feel has been evolved to be automated to help in the betterment of humanity and all its kinds. Through this we have overcome the harsh work conditions. IoT has made its mark by leading us to a safe, smart, and sustainable future. At this point in time, the field of IoT is at its peak of innovations, shaping every domain.

Sericulture is the heart of raising silkworms for silk production. India being the second largest producer of silk in the World. Sericulture has been a root of the social, economic, cultural and political progress of India. The seasonal differences in the environmental components considerably affect the genotypic expression in the form of phenotypic output of silkworm crops such as cocoon weight, shell weight, and cocoon shell ratio. The variations in climatic change and global warming emphasize the need for management of temperature and relative humidity for the healthy development and sustainability of the cocoon. This paper enables us to help the sericulture department in enabling the safe and assured healthy growth of the silk worms with modulated temperature controller, fully equipped disease detecting and protection through automated spaying medicine system. At present, the farmer interacts directly with the diseased worms, making farmers face serious health hazards due to the chemicals used here. The automated system will reduce the need of manpower, leaving no place for the human error. In a largescale area, it is quite difficult for a farmer to monitor the efficiency and manage the process of rearing the worms, but through this system by implementing the smart technology, the farmers can easily monitor the process through the system and help the farmer achieve great efficiency with limited labor. Through machine learning classification algorithm, we can classify the worm into their status of being healthy or diseased for which we have utilized image processing to capture the pictures of worms.

II. LITERATURE SURVEY

[1] Title: Intelligent Control System for Sericulture
Author: M.A. Dixit, Amruta Kulkarni, Neha Raste & Gargi Bhandari
Year- 2015 IEEE
Sericulture is basically a practice of producing silk by rearing silkworms. Stringent control of several environmental parameters such as temperature, relative humidity, light, air flow and air quality during the lifecycle of a silkworm assures improvement in quality and quantity of silk.
It should be noted that every moult i.e. growth stage of a silkworm requires a certain set of values of environmental parameters to achieve an optimum yield. This requirement varies for every moult. For e.g. early stages of silkworm require relatively higher temperature as they are highly active and eat vigorously. Machine Learning is the scientific discipline that gives computers the ability to learn without being explicitly programmed. The need of Machine Learning in this control system becomes justified due to the lack of existence of any 'optimum curve of yield' at present. Consequently, the system needs to form its own curve from raw data.
[2] Title: Management of Climatic Factors for Successful Silkworm
(Bombyxmori L.) Crop and Higher Silk Production: A Review
Author: V. K. Rahmathulla
Year- 2012
The proposed system discuss about the role of temperature and humidity on growth and development of silkworm including recent studies on heat shock protein. Silkworm is one of the most important domesticated insects, which produces luxuriant silk thread in the form of cocoon by consuming mulberry leaves during larval period. The growth and development of silkworm is greatly influenced by environmental conditions. Temperature plays a vital role on the growth of the silkworms. As silkworms are cold-blooded animals, temperature will have a direct effect on various physiological activities. In general, the early in star larvae are resistant to high temperature which also helps in improving survival rate and cocoon characters.
Humidity plays a vital role in silkworm rearing and its role is both direct and indirect. The combined effect of both temperature and humidity largely determines the satisfactory growth of the silkworms and production of good-quality

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

cocoons. It directly influences the physiological functions of the silkworm. The young-age silkworms can withstand to high humidity conditions than later-age worms and under such condition, the growth of worm is vigorous. Like other animals, silkworms also require fresh air. By respiration of silkworms, carbon dioxide gas is released in the rearing bed. The effect of temperature on the growth and development of silkworm has been studied extensively; however, much attention has not been paid on the effect of temperature one mbryonic development. It has been reported that in exothermic organisms, when rate of development is plotted against temperature, a sigmoid curve is obtained with an almost linear correlation in central temperature range. Temperature is a parameter in developmental cycle, which can be manipulated experimentally, but its effect is very complex for interpretation.

[3] Title: Arduino based automated sericulture system
Author: Poornima G R, Farheen Taj , Gavinya T M , Madhu.G , Madhubala B N
Year: 2018
Sericulture is a science which deals with rearing of silk worms and production of silk. In India, most of the rural livelihood is sericulture and is the base for financial, social, political and intellectual advancements and upliftment since. Silk is called the queen of textiles due to its glittering luster, softness, elegance, durability, and tensile properties. Although there are several commercial species of silkworms, bombyx mori is the most widely used. Silkworm is one of the important domesticated insect, which produces rich silk thread in the form of cocoon by consuming mulberry leaves during larva period. But during the transformation from Larva to Silk, the silk worm has to pass many phases. In each phase the silkworm monitoring is a greatest challenge for the farmer. Therefore, in this paper we proposed a method for automation in sericulture system using Arduino board. It deals with the regulating of climatic conditions such as temperature and humidity in the farm.

III. PROPOSED SYSTEM

1.Software Requirements

The different software requirements required by the application are as follows:

- Operating System: Microsoft Windows 7 or later, Ubuntu 14.x or later
- Architecture: 32-bit or 64-bit versions are required
- Language: Python 3.6, Java, C
- IDE: Spyder, Jupyter Notebook, Notepad++

2. Hardware Requirements

The following describe the hardware requirements for ideal running of the application:

- Processors: 2.2 GHz Intel Core i3 and above
- Memory: 8 GB 1600 MHz DDR3
- Storage: 500 GB Hard-disk
- DHT 11 (temperature and humidity sensor)
- NodeMCU
- Fan
- Bulb
- Esp32 Camera
- Arduino UNO
- Servo Motor
- Relay
- Water Pump
- MQ9 Sensor
- LDR Sensor

IV. IMPLEMENTATION

The overview of the system is represented in Figure below. It shows the different modules involved in building the system. Raw data is captured by sensors and the camera. The required parameters from this processed data is filtered and is given as an input to the sensor fusion for further decision making. Based on the output of sensor fusion, the system is now able to detect and classify diseased worms and help them get better along with modulating the temperature according to the needs of the worm. This real-time application can be viewed on a display monitor.

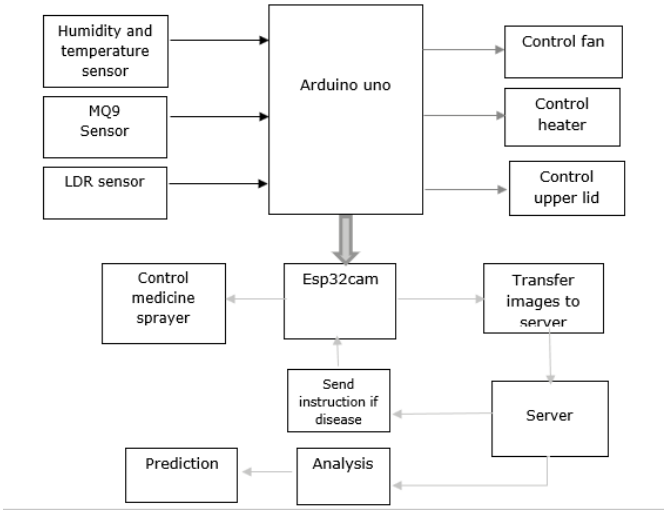

Fig. System Architecture

1. Modules

1.1 Controlling fan and bulb

This DHT11 is a temperature and humidity sensor that features a calibrated digital signal output. It is integrated with a high-performance 8-bit microcontroller. The fan, bulb and DHT 11 are connected to a power supply and to the arduino UNO. An arduino UNO is an open-source microcontroller development board. It can read sensors and control actuators like motor and fan. The data collected by the DHT 11 sensor is sent to the Arduino UNO for processing. Based on this data the bulb and fan are either switched on or off.
The optimum temperature is fixated between 22 to 26 degrees, anything below or above this threshold will cause the bulb to switch on or off respectively. Further on, the humidity of the

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

closed space is altered using a fan i.e if the humidity goes below or above the given range of 75-80%, the fan switch off or on respectively.

Fig. Arduino UNO

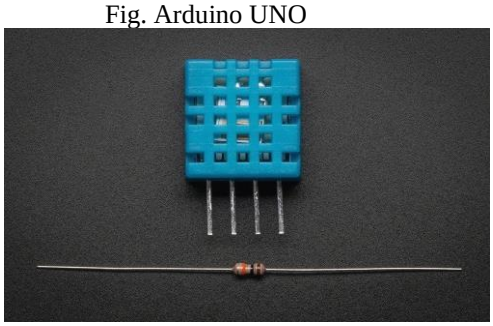

Fig. DHT 11

1.2 *Controlling lid*

The automated model has lid on it. The lid is fitted with Servo Motor so that when the lid is need to be open, the Servo Motors get the instruction to rotate in particular angle and when it to be close, Servo Motor rotates in the anticlockwise direction.

Due to its high sensitivity and superfast response time, it is suitable for detecting LPG, CO and CH4. The sensitivity is adjusted by using a potentiometer. The MQ9 sensor is connected to the arduino, when the gas level reaches its potential value the arduino triggers the Servo Motor to rotate so that the lid opens up and when the gas level comes down to a normal level the Servo Motor rotates in anticlockwise direction to close the lid. Servo motor may be DC or AC powered.

1.3 *Controlling water pump*

ESP32 camera is mounted inside the closed, controlled environment. This enables us to have livestreaming along with recognition capabilities. The camera captures the pictures at even intervals of duration 5 seconds. The data from the camera is sent through the NodeMCU to the server. Where, data gets classified by Support Vector Machine algorithm through which we determine a worm to be either diseased or healthy. Later, based on the data the water pump gets activated. If diseased, the pump dispenses medicine else does nothing. The water tank is filled with medicine. The below adds a detailed explanation to this context.

1.4 *LDR sensor*

Light Dependent Resistor (LDR), also called as photoresistors. It is a sensor that changes its resistance when light intensity falls on it. It is located inside the controlled environment and is used as a fire detection and alarmin device.

Fig. LDR sensor

2. MODULES OF IMAGE PROCESSING:

The proposed system consists are four modules of following steps to interpret the Silkworm from the input image such as:

2.1 Preprocessing and segmentation:

Image processing is necessary for image enhancement. During preprocessing RGB image is converted into grayscale. The brightness of the pixel is represented with a single number for all grayscale images. Every image lies between the values 0 to 255 where 0 indicates black and 255 indicates white. All images are stored as an 8 bit image. Image segmentation is basically performed to locate the Silkworm object in image.

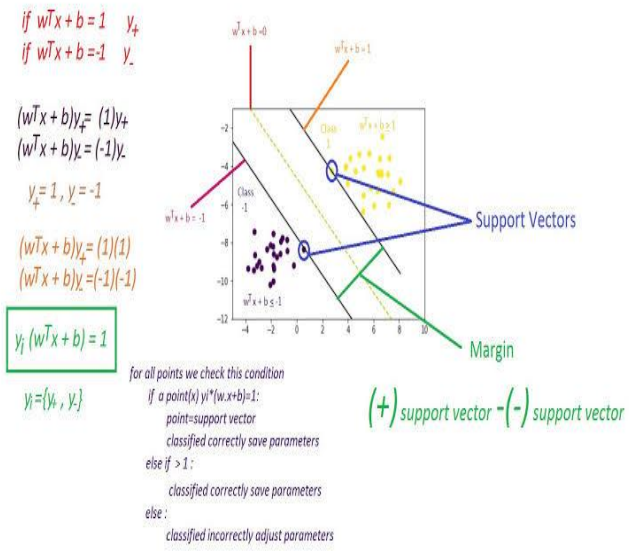

Fig. SVM Algorithm

2.2 Feature Extraction:

Feature Extraction stage is necessary because certain features has to be extracted so that they are unique for each Silkworm. After the decision is made that a Silkworm-Diseases and Non- Diseases is present, then the last frame is taken into consideration and features. Finally the Feature Extraction is extract the features (Size, Pixels, Labels) in all Images (Silkworm) dataset are store in 'Support Vector Machine Model', best on train data.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

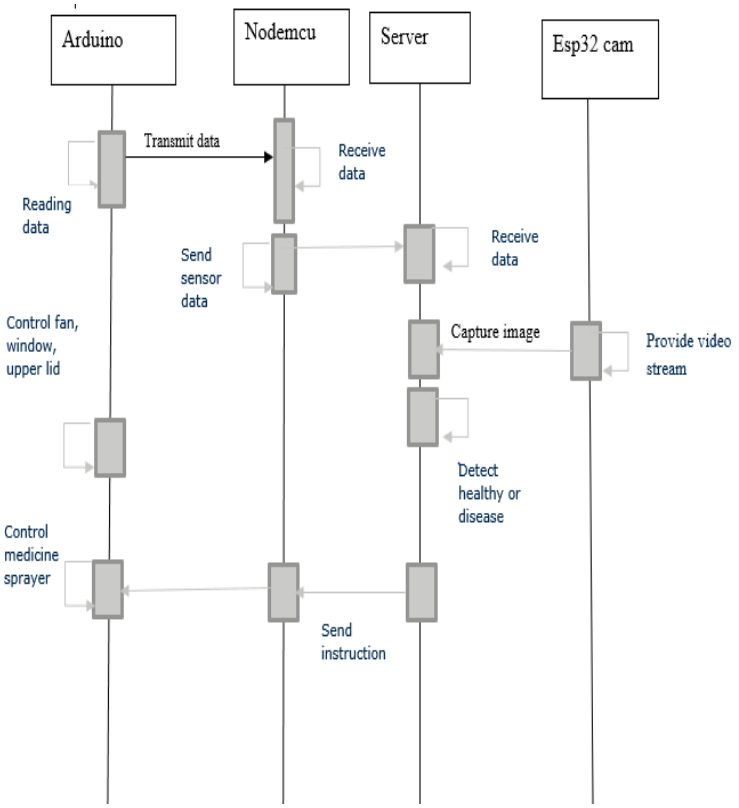

Fig. Sequence Diagram

2.3 Classification:

Classification of Silkworm is done with the help of various features calculated previously. The five bit binary sequence is thus generated to uniquely recognize and utilize these recognized the recognized Silkworm for supporting computer interaction. By the feature extraction significant peak is encoded as 1 while insignificant peak is encoded as 0 based on intersection to the threshold line. We used in Support Vector Machine (SVM) is a supervised machine which can be used for both classification and regression challenges.

Fig. Healthy Silkworm

Fig. Diseased Silkworm

3. Results:

Different images were tested (test data) and found that the new technique of classification was found to show 96% accuracy. Some images tested with other database images are given in the results analysis. In Results analysis are real time detect in Silkworm-Diseases and Silkworm-Non-Disease (Healthy) and Silkworm recognize when live camera is start then capture the test images (Silkworm)that time compare the features 'Support Vector Machine Model', if it matches the dataset after the process in display the result.

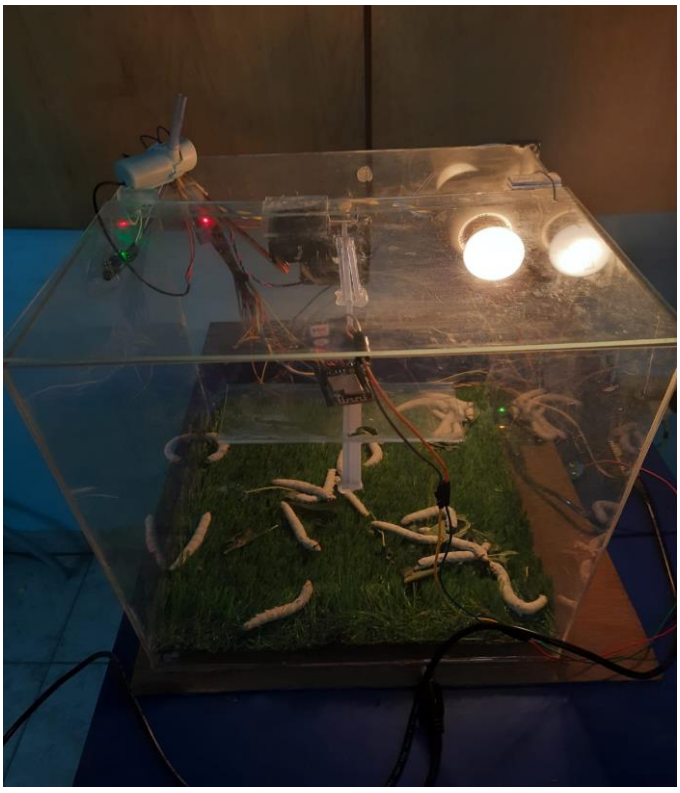

Fig. Final Outcome

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

V. CONCLUSION

IoT is widely used in connecting devices and used to gather information. The system is designed to remotely monitor the applied parameters such as humidity, temperature, and accumulation of harmful gases, this information collected can be used to automate the climatic conditions within the closed environment. The worms are monitored by using a camera that collects data in form of pictures at equal specified intervals. The data collected here is used determine if the worm is healthy or diseased. If the worm is found to be diseased, an automated pump will dispense the medicine. Thus, the system will help the farmers to limit physical labor involved in silk production, and to increase the yield as well as the silk quality. This is done by maintaining précised parameters such as humidity, temperature, and gases as well as monitoring and classification in the controlled environment with the help of IoT.

VI. REFERENCES

[1] Srinivas B, Khushi Kumari, Goverdan Reddy H, Niranjan N, Hariprasad S A and Sunil M P, "IoT based Automated Sericulture System": International journal of recent technology and engineering, July 2019.
[2] M.A. Dixit, Amruta Kulkarni, Neha Raste & Gargi Bhandari" Intelligent Control System for Sericulture" August 2015 IEEE.
[3] Poornima G R, Farheen Taj, Gavinya T M, Madhu G and Madhubala B N, "Arduino based Automated Sericulture system", Information and communication technology, May 19 2018.
[4] ZOU Cheng-jun, "Research and Implementation of Agricultural Environment Monitoring based on Internet of Things", Fifth International Conference on Intelligent Systems Design and Engineering Applications, 2014.
[5] Ahmad Nizar Harun, Mohamed Rawidean Mohd Kassim, Ibrahim Mat, Siti Sarah Ramli, "Precision Irrigation using Wireless Sensor Network", International Conference on Smart Sensors and Application (ICSSA), 2015.
[6] Narayut Putjaika, Sasimanee Phusae, Anupong Chen-lm, Dr. Phond Phunchongharm, and Dr. Khajonpong Akkarajitsakul, "A Control System in an Intelligent Farming by using Arduino Technology", Fifth ICT international Student Project Conference (ICT-ISPC), 2016.
[7] ZOU Cheng-jun, "Research and Implementation of Agricultural Environment Monitoring based on Internet of Things", Fifth International Conference on Intelligent Systems Design and Engineering Applications, 2014.
[8] Mubashar Hussain,Shakil Ahmad Khan,Muhammad Naeemand M. Farooq Nasir "Effect of Rearing Temperature and Humidity on Fecundity and Fertility of Silkworm", BombyxmoriL. (Lepidoptera: Bombycidae) International Journal of Wireless and Mobile Networks (IJWMN), volume 3, No.1, 2011. 47