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"SILKWORM DISEASE DETECTION USING AI AND ML"

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ABSTRACT—

Sericulture, a critical industry in the textile market, faces challenges such as labor costs and health issues. To address these challenges, this paper introduces a novel approach using artificial intelligence (AI) integrated with Raspberry Pi, a low-cost, single- board computer, and a camera for sericulture management. The proposed system employs computer vision algorithms for real-time monitoring of silkworms and their cocoons, enabling the detection of growth parameters, health conditions, and potential disease outbreaks. By leveraging the computational capabilities of Raspberry Pi, the system provides actionable insights to optimize rearing conditions and enhance productivity. Additionally, AI integration enables task automation, reducing manual labor and improving operational precision. This solution not only ensures silkworm well- being but also enables data-driven decision-making for resource optimization and increased silk yield. By combining AI, Raspberry Pi, and camera technology, this study contributes to sustainable and high-yield silk production, advancing sericulture techniques for a more resilient industry.

Keywords: Sericulture, Artificial Intelligence, Raspberry
Pi, Computer Vision, Silkworm Disease Detection, Automation, Resource Optimization, Silk Production, Sustainable Practices.

I. INTRODUCTION

Sericulture, the ancient practice of silk production, holds significant economic and cultural importance globally. In recent years, the integration of advanced technologies has emerged as a transformative force in modernizing sericulture. Artificial Intelligence (AI), in particular, has the potential to revolutionize traditional sericulture practices, offering improvements in efficiency, yield, and quality.

This paper explores the application of AI in sericulture, focusing on the utilization of Raspberry Pi, an affordable, credit card-sized computer, and a high-resolution camera. This integration enables real-time monitoring and analysis of critical parameters in silk production, enhancing decision- making and intervention strategies for sericulturists.

By leveraging computer vision and machine learning, the Raspberry Pi-based system can analyze silkworm health, monitor environmental conditions, and detect abnormalities that may impact silk production. This intelligent system empowers sericulturists to optimize their practices, leading to increased yield and ensuring the well-being of silkworms.

The study emphasizes the development and deployment of an AI-driven sericulture system, emphasizing its benefits for sustainable and enhanced silk production. The fusion of AI with Raspberry Pi and camera technology presents a promising avenue for modernizing sericulture, boosting productivity, profitability, and preserving this traditional craft.
This paper underscores the transformative potential of AI in sericulture, offering insights into the future of silk production and the preservation of this ancient art form.

II. LITERATURE SURVEY

Immunodiagnostics of silkworm disease:
Authors: Vankadara Sivaprasad and Pooja Makwana

Abstract: This paper [1] analyzes the susceptibility of the Mulberry silkworm, Bombyx mori L., to various microorganisms causing silkworm diseases. These pathogens include viruses (BmNPV, BmIFV, BmDNVs, BmCPV), bacteria (Bacillus thuringiensis, Staphylococcus spp., Streptococcus spp.), fungi (Beauveria bassiana, Nomuraea rileyi, Aspergillus flavus), and microsporidians (Nosema bombycis, Vairimorpha spp., Pleistophora spp., Thelohania spp., and Microsporidium spp.). Silkworm diseases result in significant crop losses for farmers, with no curative measures available; only general prophylactic measures can prevent their spread. External symptoms of these diseases are mostly atypical and challenging to identify without specific tests.

Diagnostic tests, including precipitin, fluorescent antibody, immunoblotting, latex agglutination, ELISA, and dipstick immunoassays, detect these pathogens with high sensitivity and specificity in silkworm tissue and fecal matter. These tests certify young silkworm larval rearings as disease-free, allowing further rearing and cocoon production. The paper also discusses methods for isolating, propagating, and purifying silkworm pathogens, along with protocols for various immunodiagnostic methods.

Convolutional Neural Networks Jinu Celine, Dr. Anto Kumar R.P

Authors:

Abstract: This paper[2] provides a comprehensive review of Convolutional Neural Networks (CNNs) and their applications in extracting information from datasets of different dimensions. CNNs have gained significant popularity in deep learning, demonstrating high accuracy in solving complex engineering problems across various fields such as wireless communications, medical signal processing, and biomedical applications. This survey presents a brief overview of CNNs, highlighting their applications in image classification and segmentation, object detection, video processing, and speech recognition. Major companies such as Google, Microsoft, AT&T NEC, and Facebook have established research groups focusing on exploring new CNN architectures, indicating the widespread adoption of CNNs in image processing and computer vision competitions.

Convolutional Neural Network:

Authors: Jinu Celine, Dr. Anto Kumar R. P

Abstract: This paper[3] explores the application of artificial intelligence (AI) to improve diagnostic accuracy and efficiency. While existing literature has examined various AI approaches for diagnosing diseases, there is a lack of comprehensive overview of AI applications in digitalized healthcare services. This paper fills this gap by critically reviewing the AI landscape in diagnostics and proposing a research agenda. It aims to provide practitioners with insights into the benefits of AI in healthcare while highlighting key challenges that need to be addressed for successful AI implementation in disease diagnostics.

III. METHODOLOGY

The configuration of our system. There are following components Raspberry Pi Module 4, Raspberry Pi Camera Module 2,SD Card.

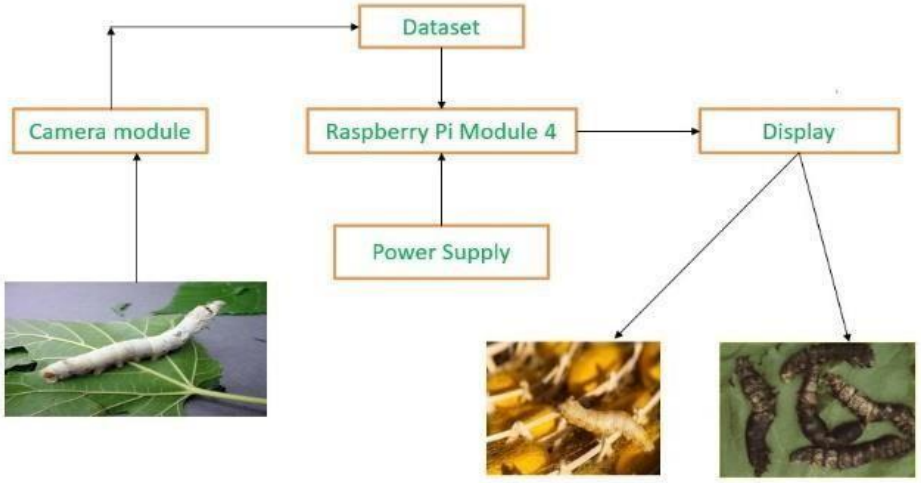

Fig1: Block diagram of Silkworm disease detection using AI and ML

The Raspberry Pi (RPi) and camera modules synergistically facilitate object identification through a systematic approach. The RPi integrates a Camera Serial Interface (CSI) port, enabling seamless connection with the camera module. The camera is activated via the RPi configuration, and programming languages like Python are employed for camera control and image/video capture. The Pi camera library for Python streamlines camera access and manipulation. Notably, the RPi does not possess intrinsic object identification capabilities; instead, image processing and computer vision techniques are utilized, often leveraging libraries such as OpenCV. Images are captured using the camera, following which algorithms analyze and identify objects based on attributes like color, shape, or patterns. Advanced object recognition tasks can be achieved through the implementation of machine learning models, albeit requiring additional setup and training. This methodology offers a comprehensive approach for object identification using RPi and camera modules, paving the way for diverse applications in surveillance, automation, and robotics.

IV. COMPONENTS

A. Hardware components 1. Raspberry Pi Module 4

A Raspberry pi has everything that a computer needs it acts as a mini computer .It has a tiny pacakage it consist GPU and CPU are present in a single integerated circuit it consist of other components ,ram which acts as a storage unit and has a port for SD card to implement it SD card is used to store the store the OS

2. Raspberry Pi Camera Module 2

The camera module is used to capture high definition video, As well as still photography. It has a plenty of advanced features .It is used as detecting minute image on the external appearance on the object.In our project we use camera module to capture the image of the silkworm and send it to the raspberry pi

3. S D Card

SD Card is a non volatile flash memory that is implemented in portable device. Raspberry pi module has a SD card slot for storage. It uses it has a primary storage for storing the os and operational files on to the SD card.It can read and write to the SD card during operation.

B. Software Requirement

1. Visual Studio

Visual studio, an integrated development environment used for coding, debugging and developing software applications. It is implemented in writing the code and debugging the the code in our project we are using python for debugging. Writing the code where the code is written for the analyzation of the image captured based on the external apperrance.Visual studio code is a powerfull tool it is used in entire development cycle.

2.Linux OS

It is implemented for installation process on the Sd card Installing distributed Linux for raspberry pi installing of library take place which contain open cv for image processing machine learning framework like tensorflow and any other essential library. It consist of disease detecting algorithm like,it involves training the model through machine learning.and labelled dataset of image.

V. Flowchart

Figure below shows flow chart of silkworm disease detection. In the below shown figure send the command to start a camera. The camera capture the

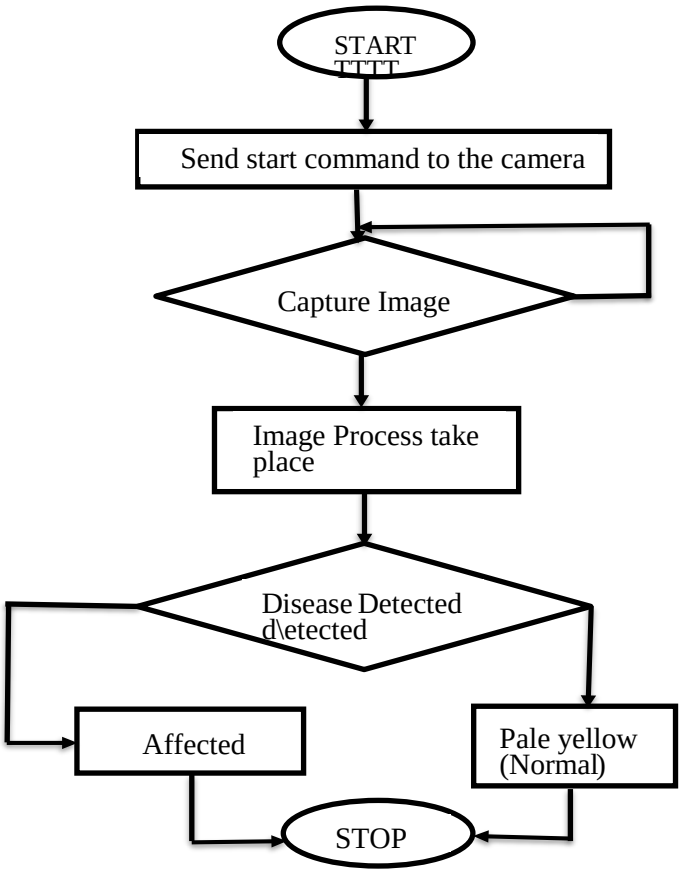

image and compares whether the aquired data matches with the predefined data. If data matches sends result as if the worm is affected or it will declare as pale yellow

Fig 2. Flow chart of silkworm disease detection

The model was designed using Raspberry Pi Module 5, Raspberry Pi Camera Module 2, SD Card Figure 2.1 shows the block diagram of the proposed system. Through the camera module the silkworm picture is captured.Through the raspberry pi 5 which is programmed with AL, the captured image of silkworm is analyzed based on the features like pattern, colour, shape etc. This analyzation is done through the data sheet that had been uploaded. By the help of the data given in the data sheet the results will be displayed.

V. RESULT ANALYSIS

Fig 3. Pale yellow

Fig4: Affected

The above figure shows the condition of the silkworm. If it shows the pale yellow it defines that it is healthy enough and can be rared for future process. If it shows it is affected it it must be separated from others.

V. CONCLUSION

The integration of Artificial Intelligence (AI) and machine learning with Raspberry Pi and camera technology offers a transformative approach to modernize sericulture practices. This study has demonstrated the potential of AI-driven systems in enhancing silk production efficiency, yield, and quality. By enabling real-time monitoring and analysis of critical parameters, such as silkworm health and environmental conditions, the system provides sericulturists with valuable insights for informed decision-making and intervention strategies. Moreover, the intelligent system contributes to sustainable sericulture practices by optimizing resource utilization and ensuring the well-being of silkworms.

Overall, the fusion of AI with Raspberry Pi and camera technology presents a promising avenue for advancing sericulture, ultimately benefiting sericulturists, the silk industry, and preserving this ancient craft for future generations.

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