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SMART SERICULTURE USING IMAGE PROCESSING

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ABSTRACT: In this paper, Sericulture involves raising silkworms to produce silk and is crucial for India's development. Temperature and humidity are vital for healthy silkworm growth. We used a MEGA controller to monitor silkworms in real-time. Image processing helps identify infections of silkworms. The MEGA controller automates tasks like temperature control, reducing manual work for farmers. It also monitors the environment in the silkworm rearing room. Image processing detects color changes in silkworms, indicating the infections.

I. INTRODUCTION

The Internet of Things is a modern technological trend (IoT), which resulted in the diversity of each object's detection, activation and transmission across the internet by perceiving itself through a unique addressing format Furthermore, the components are linked remotely for a more elegant use. More than M2M correspondence. The performance of IoT is significantly higher because to Wireless Sensor Networks (WSN), Global System for Mobile Communications(GSM). The Internet of Things (IoT) is a collection of network connections and network systems with unique characteristics that allow applications to be stored in various locations. According to a report by the Central Silk Board, India ranks second in the world for silk production. India, on the other hand, contributes only 15% of global silk production, compared to China's 85% . Sericulture is the science of growing silkworms for the purpose of producing silk. Sericulture is primarily concerned with the cultivation of silkworms for the purpose of producing silk. Silk production is a time-consuming, labor-intensive, and challenging process. Silkworms are believed to be one of the most important housetrained organisms, harvesting dynamic silk-fiber in the form of cocoon by eating mulberry leaves during their larval stage. Sericulture is the process of producing raw silk by rearing caterpillars [Bombyx mori]. Silk is referred to as the 'QUEEN OF TEXTILES' and is a naturally occurring animal fibre. Sericulture is a cottage enterprise based on agriculture. Silkworm care is primarily concerned with the preparation of silk through the care of silkworms. The lack of mechanisation in the sericulture industry is the primary source of the huge disparity.the seasonal variations disrupt changes in the environment in the silkworm raising house, affecting cocoon and shell weight ratios as well as cocoon fineness. The change in the atmosphere inside the silk worm raising home is disrupted by seasonal variations, The cocoon and shell load ratio is also impacted by cocoon uniformity. As a result of the environmental change, the silk quality in the silkworm rearing house is altered.

II. LITERATURE REVIEW

Amandeep et al. (2017) highlighted the need for technological innovation in agriculture to boost productivity. S. Rajeswari, K. Suthendran, and K. Rajakumar, "A smart agricultural model by integrating IoT, mobile and cloud-based big data analytics," in 2017. Divya Dharshini B Adharse et al. (2016) focused on automated sericulture systems, emphasizing the importance of temperature and humidity control. Dixit M.A et al. (2015) stressed the necessity for intelligent control systems in sericulture, particularly during critical stages. Sreekantha D K & Kavya A M, "Agriculturing crop monitoring using IoT in study", 2017. Lokesh K et al. (2017) introduced an IoT-based mobile robot for smart agriculture, aiming to enhance efficiency and crop yield. These studies collectively underscore the potential of innovative technologies in transforming agricultural practices towards greater sustainability and productivity.

III. METHODOLOGY

In response to the observed impact of dynamic environmental variations on silkworm health and silk production, our paper methodology shown in Figure 1 aims to address these challenges through an integrated approach leveraging automation and sensor technology.

Firstly, our methodology emphasizes the implementation of an automated monitoring system utilizing sensors for temperature and humidity. These sensors, integrated with Arduino MEGA, continuously collect data on environmental conditions within the rearing house. This real-time monitoring allows us to track fluctuations and deviations in key parameters that could affect silkworm health and silk quality.

Additionally, our methodology incorporates image processing techniques to detect diseased worms within the rearing environment. By analyzing images captured from a camera installed within the rearing house, we can identify worms exhibiting signs of illness or abnormalities. This automated detection process enables early intervention, preventing the spread of diseases and minimizing potential negative impacts on overall silk production..

Overall, our paper methodology combines automated monitoring, image processing, and intervention mechanisms to address the challenges posed by environmental variations and disease outbreaks in sericulture. By leveraging technology to enable proactive management and care of silkworms, we aim to enhance both the quality and quantity of silk production, contributing to the sustainability and efficiency of the sericulture industry.

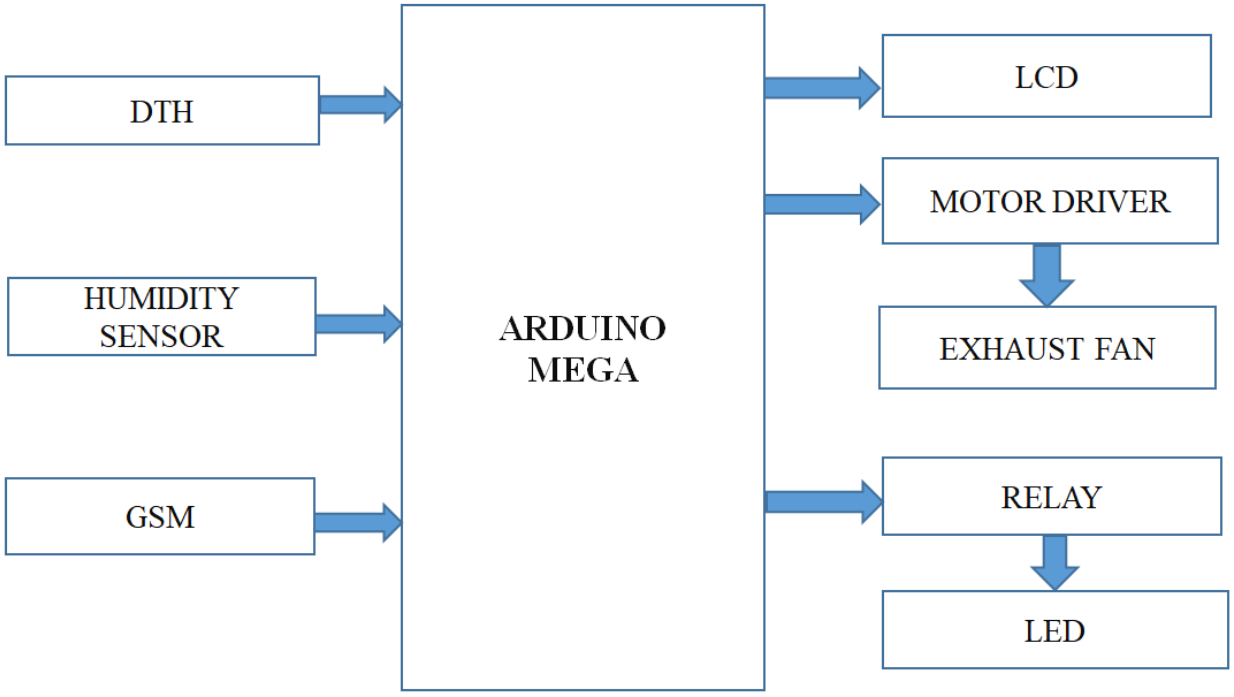

Figure 1: Block diagram of Proposed method

The silkworm warehouse operates under strict environmental conditions to ensure the health and productivity of the silkworms. Maintaining a temperature range between 23 to 28 degrees Celsius is crucial, as temperatures exceeding 30 degrees Celsius can have adverse effects on the worms' health.. This sensor continuously measures various air pollutants, ensuring that the environment remains conducive to the silkworms' well-being. Furthermore, the warehouse is equipped with a light-dependent relay system that ensures adequate lighting throughout the day. In the morning, natural sunlight provides illumination, but if the light intensity drops below a certain threshold, the sensor triggers the relay, activating artificial lights to maintain a consistent lighting environment. This 24/7 lighting schedule is essential for the silkworms' growth and development. Overall, the warehouse employs advanced technology and meticulous monitoring to create an optimal environment for silkworm rearing, thereby maximizing silk production and ensuring the health of the silkworm population.

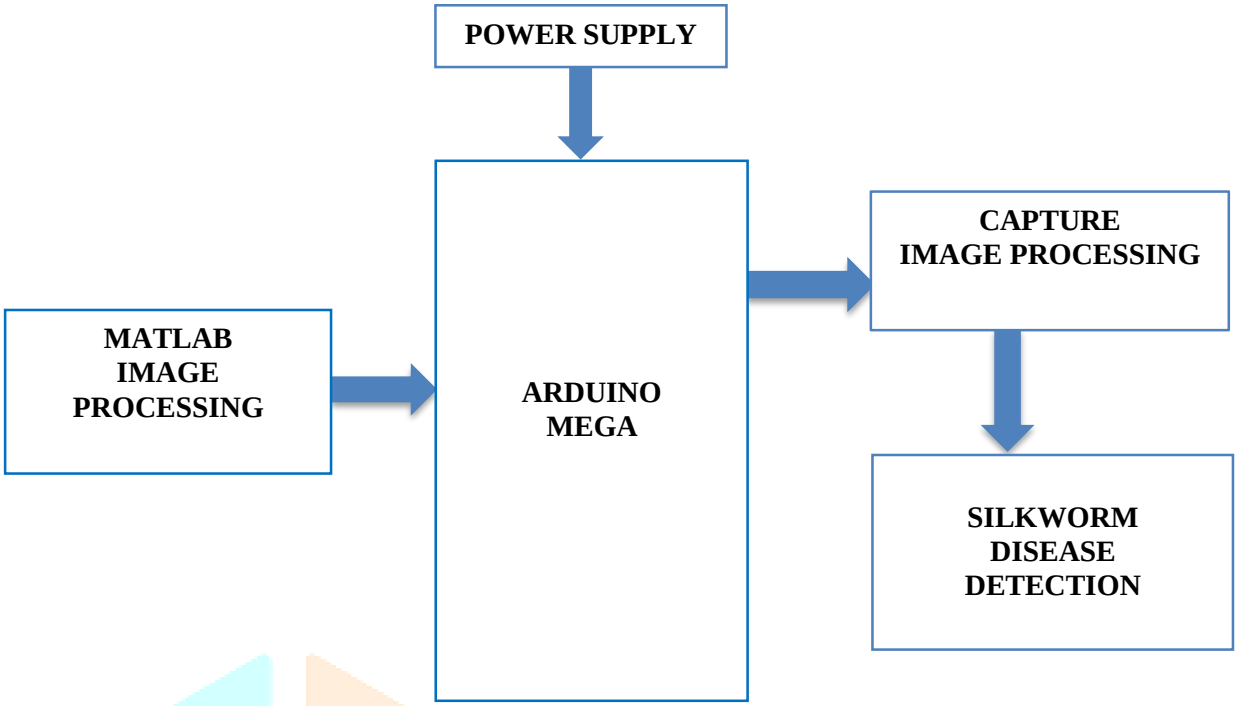

Figure 2: Block Diagram for maintaining the health of Silkworm

Automated sericulture, facilitated by MATLAB image processing, represents a significant leap forward in silk production shown in Figure 2. This approach streamlines the processing of images, making it easier and more efficient to monitor and manage silkworm populations. By integrating cost-effective wireless sensor networks powered by IoT technology, crucial environmental factors like temperature, humidity, and light intensity can be continuously monitored and adjusted as needed, all without the need for extensive human intervention. This automation not only reduces labor requirements but also promotes economic development by optimizing silk production processes. In rural areas, where sericulture often thrives, such advancements contribute to increased productivity and improved quality of life for the local communities. Moreover, the utilization of deep learning algorithms enhances disease detection and management within silkworm populations. By automatically identifying afflicted silkworms and classifying the type of disease they may be experiencing, prompt and targeted treatment recommendations can be provided, minimizing losses and maximizing overall silk production efficiency. This holistic approach to automated sericulture not only revolutionizes traditional practices but also holds promise for sustainable growth and advancement in the silk industry.

IV. RESULTS AND DISCUSSION

The paper is a sophisticated system, denoted as "5", designed to monitor various environmental factors crucial for the growth and development of silkworms. Through a comprehensive array of sensors, it meticulously tracks temperature, humidity ensuring optimal conditions within the culture environment. Moreover, it actively regulates this environment using fans and heaters, ensuring that the conditions remain conducive for the silkworms' well-being.

The integration of an LCD matrix adds another dimension to the system's functionality. Through this interface, users gain real-time insights into the status of all sensors, ensuring transparency and enabling timely adjustments as needed. This live display functionality not only enhances user experience but also serves as a critical tool for decision-making in silkworm management.

Furthermore, the incorporation of cloud connectivity via Rest API elevates the system to a new level of accessibility and usability. Users can remotely access live data, facilitating informed decision-making and proactive management strategies. This seamless integration with cloud services underscores the system's commitment to leveraging cutting-edge technology for enhanced efficiency and effectiveness.

In summary, the paper represents a convergence of advanced sensor technology, image processing algorithms, and cloud connectivity to create a comprehensive solution for silkworm cultivation. Its ability to monitor environmental factors, detect diseased silkworms, and provide real-time data to users reflects a commitment to innovation and excellence in agricultural practices. With its multifaceted functionality and user-friendly interface, "5" stands as a testament to the potential of technology to revolutionize traditional farming practices and drive sustainable agricultural outcomes shown in Figure 3 and 4.

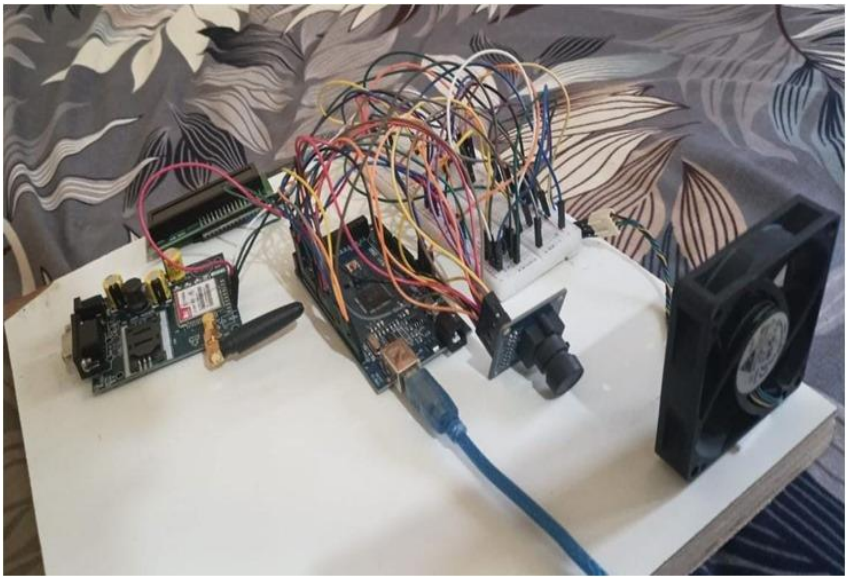

Figure 3: Implementation of smart Sericulture

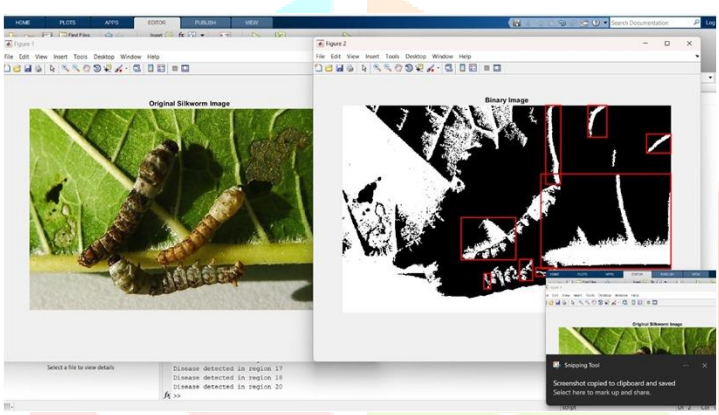

Figure 4: Worm Images (RGB to HSV)

V. CONCLUSION AND FUTURE SCOPE

The "Automated Sericulture System" represents a significant advancement in the field of sericulture, offering automated control and precise management of environmental conditions crucial for silkworm cultivation. By harnessing technology-based innovations, this system streamlines sericulture processes and ensures optimal conditions within the silkworm growing environment.

Through continuous monitoring and directed control, the system effectively maintains key environmental parameters such as temperature, relative humidity, and light intensity within predefined optimal ranges. This automation not only enhances the efficiency of sericulture operations but also minimizes the risk of environmental fluctuations adversely affecting silkworm health and productivity.

One of the system's key strengths lies in its adaptability to varying ambient conditions. By dynamically adjusting parameters based on real-time data, the system ensures stability and consistency in the silkworm raising environment. This adaptability enhances resilience to external factors, thereby promoting sustainable sericulture practices.

Moreover, the system's cost-effectiveness and energy efficiency make it a compelling solution for sericulture operations of all scales. By optimizing resource utilization and reducing reliance on manual intervention, the system helps minimize operational costs and environmental impact, contributing to overall sustainability.

The successful implementation and testing of the prototype system validate its effectiveness in monitoring and controlling environmental conditions within the silkworm raising home. The positive outcomes observed in the implementation test highlight the system's potential to revolutionize traditional sericulture practices, saving both time and money while improving overall productivity.

Furthermore, the simplicity of setup and ease of use make the system accessible to a wide range of users, from small-scale farmers to commercial sericulture enterprises. This accessibility democratizes access to advanced sericulture technologies, empowering stakeholders across the industry to adopt modern, efficient practices.

In conclusion, the "Automated Sericulture System" represents a transformative solution for sericulture, offering automation, precision, and efficiency in environmental management. Its potential to enhance productivity, reduce costs, and promote sustainability positions it as a valuable asset in the modernization of sericulture practices worldwide.

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