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COLOR BASED OBJECT SORTING AND COUNTING SYSTEM

Mrs.C.ARCHANA[1],BHUKYA SAI SRAVANI[2], UPPOLLA NIHATHA[3], NAMALA AJAY KUMAR[4],SHAIK MINHAZ[5]

[1] Assistant Professor, Department of Computer Science and Engineering, Teegala Krishna Reddy Engineering College, Medbowli, Meerpet, Saroornagar, Hyderabad-500097

[2,3,4,5] Students, Department of Computer Science and Engineering, Teegala Krishna Reddy Engineering College, Medbowli, Meerpet, Saroornagar, Hyderabad-500097

ABSTARCT

Sorting and counting objects accurately and efficiently is a critical requirement. Traditional methods rely on manual labor or conventional image processing techniques, which are prone to errors and inefficiencies. This project proposes a Color Based Object Sorting and Counting System utilizing deep learning techniques to enhance speed and precision. The system employs a convolutional neural network (CNN) for real time object detection, classification, and sorting based on their colors. A combination of image preprocessing and augmentation ensures robust performance under varying lighting conditions and object orientations. The proposed system incorporates a camera module to capture images of objects on a conveyor belt, which are then processed by a trained deep learning model to identify and classify objects by color. Actuators and robotic arms are used to sort objects into designated bins. The system also includes an object counting module that accurately keeps track of the sorted items, enabling real time monitoring and inventory management. Experimental results demonstrate high accuracy in color based object classification and counting, showcasing the potential for automation in industries such as manufacturing, packaging, and logistics. The integration of deep learning significantly reduces human intervention, improves productivity, and minimizes errors, making this approach a scalable solution for future industrial automation applications.

I.INTRODUCTION

Color is a very important feature based on which objects are distinguished, sorted and various industrial applications are performed. But if color sorting is done manually, it will be extremely tedious, time-consuming and monotonous job so it is very essential to build machines and automate them to ease the job of humans and make every work precise and optimized. Automation isn't the latest form

of innovation but still, automation has arguably pinned to have created greatest influence as it is a positive step towards handling various types of machinery and processes to minimize the human involvement resulting in saving a sufficient amount of time. On the same note, this very automation can play a key role if we utilize it in sorting the objects based on the color on an industrial level where a large number of products are manufactured on a daily basis. There are some traditional methods already in existence for sorting the objects like placing the objects on the conveyor belt and sorting one at a time but these methods are expensive and time consuming. Instead, our motto is to sort the objects simultaneously based on color in a synchronized way making the entire system more flexible. The heart of the proposed system is Raspberry Pi which is an open-source Linux based operating system (OS). For visualizing the color of the object we will be using the IBM visual recognition model on IBM Watson Studio [1]. Upon color detection, a signal is sent to the raspberry pi which then directs that signal to the motor which will channel the object to get sorted to its respective section. A feeder will then pull the next object to get sorted. Thus, achieving an automated color based object sorting system. Color based object sorting plays a critical role in various industries, ranging from manufacturing to packaging and food processing. However, manual sorting is not only time consuming and monotonous, but it also leaves room for errors and inefficiencies. As industries scale up, the need for precise, efficient, and faster sorting systems becomes increasingly vital. Automation can eliminate human errors, optimize production lines, and drastically reduce time and labor costs. The motivation behind this project is to develop a cost effective, automated, and precise color sorting system that can be applied in industrial settings. Using Raspberry Pi, an open source platform, and IBM's Visual Recognition model on Watson Studio, the goal is to create a system that automates color detection and sorting in real time. By using machine learning and sensor technologies, the system aims to replace traditional manual sorting with a faster, more reliable, and scalable solution. This will not only enhance productivity but also contribute to overall operational efficiency, reducing waste and improving consistency in products. The implementation of such a system is poised to revolutionize industries where color differentiation is crucial, making them more streamlined and adaptable to ever growing production demands.

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II.LITERATURE SURVEY

1.Threshold-Based Color Detection Techniques in Industrial Sorting Color-based sorting systems have been widely used in industries for automating classification and separation of items based on visual features. According to Gupta et al. (2017), RGB thresholding combined with HSV transformation improves the robustness of color detection against changes in illumination. Their work involved the use of basic image processing techniques to extract object contours and apply color masks for sorting on conveyor belts. Rashid and Ibrahim (2016) proposed an Arduino-based color sorting system using an RGB sensor (TCS3200) coupled with servo motors, demonstrating cost-effectiveness for small-scale applications. These systems operate by setting static thresholds for red, green, and blue values, which are compared against object pixels in real-time to determine the sorting category. However, these methods are highly sensitive to environmental factors such as lighting intensity and background contrast, often leading to misclassification.

2. Machine Vision and Microcontroller-Based Color Sorting and Counting Integration of image processing libraries such as OpenCV with microcontrollers like Raspberry Pi and Arduino has significantly enhanced the capability of color-based sorting systems. Patel and Shah (2019) developed a real-time object detection and counting system using Raspberry Pi and PiCamera, where objects were filtered based on HSV color segmentation and tracked using contours. The system was capable of sorting colored candies moving on a belt and maintaining an accurate count with minimal latency. Singh et al. (2020) implemented a low-cost color-based object detection and counting mechanism in embedded systems, leveraging adaptive thresholding and background subtraction for improved object segmentation. These systems are often equipped with optical sensors and IR modules to detect object presence and trigger sorting actions. Although affordable and effective for basic applications, they often struggle in environments with multiple overlapping objects or noisy backgrounds.

3. AI-Enhanced Color Sorting with Hybrid Vision Models Recent advancements integrate traditional color filtering with AI-based models for enhanced sorting precision. Mehta and Kaur (2021) proposed a hybrid system that initially filters objects by dominant color regions using K-means clustering and then feeds these features into a lightweight convolutional neural network

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(CNN) for final classification and sorting. This approach reduced computational costs while increasing accuracy in dynamic lighting conditions. Similarly, Dinesh and Rani (2022) designed a vision-based sorting system capable of distinguishing between similar-colored objects using deep features extracted from pre-trained MobileNet models. While the sorting was initially based on color, the CNN refined the classification by learning subtle texture and illumination differences. These intelligent systems have shown promise in high-speed sorting environments such as recycling plants and food processing lines. However, their implementation demands higher processing power, real-time GPU support, and consistent training datasets to ensure accuracy.

III.EXISTING SYSTEM

The current systems utilize deep learning models combined with image processing techniques to identify and sort objects based on color in an automated pipeline. High quality cameras (RGB or hyper spectral) capture images or video of objects on conveyor belts. Images are processed to enhance color features (e.g., resizing, noise reduction). CNNs (Convolutional Neural Networks) Extract features and classify colors. Object Detection Models (YOLO, SSD,Faster R CNN) Detect and classify multiple objects in real time. Once classified, robotic arms, pneumatic pushers, or mechanical separators sort the objects into bins based on their color.

IV.PROPOSED SYSTEM

The Color Based Object Sorting and counting System Using Deep Learning is designed to automatically classify and sort and count objects based on their color. This system leverages deep learning techniques for accurate and efficient object detection and categorization. A camera or sensor captures real time images of the objects to be sorted as they pass through a conveyor belt or predefined area. The captured images are preprocessed to enhance quality by adjusting brightness, contrast, and removing noise for better feature extraction.

V.SYSTEM ARCHITECTURE

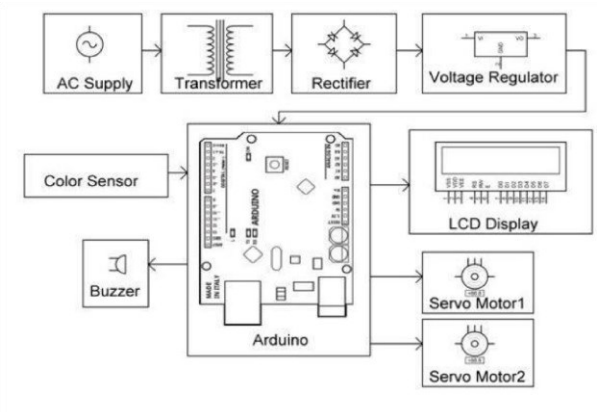

Figure 5.1 System Architecture

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The proposed project aims to develop an automated system for sorting objects based on their color, specifically designed for industrial applications where large scale sorting is required. Traditionally, color sorting has been performed manually, a process that is not only tedious and time consuming but also prone to human error. This project seeks to replace manual sorting with a highly efficient, automated system that can handle high volumes of objects, reducing both time and costs while increasing precision and scalability. By leveraging advanced technologies like machine learning and Raspberry Pi, the system will automate the entire process of object sorting based on color.

VI.OUTPUT SCREENSHOTS

The below figures represent a sample image of the result obtained in which it signifies the description of vehicle classified as bus/car/cycle e.c.t along with the amount associated with it. The results obtained can be reliable since it also differentiates between vehicles and others moving bodies.

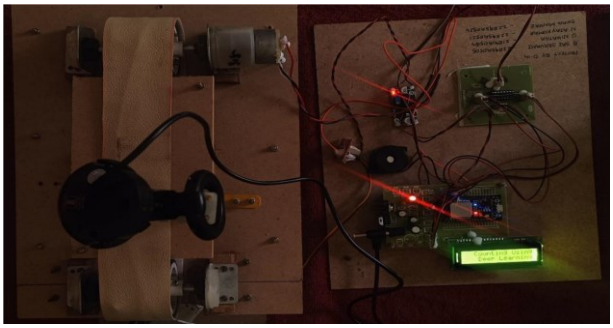

Fig no: 6.1 Proposed IoT Hardware Configuration for Color-Based Object Sorting

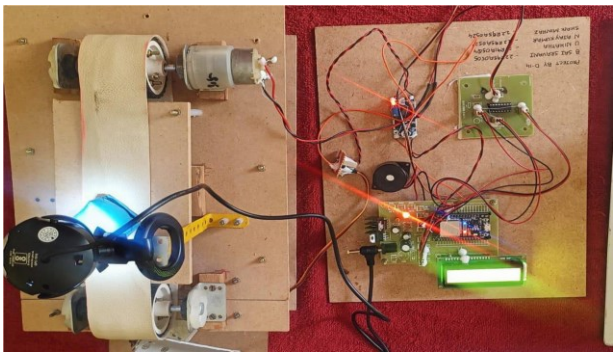

Fig no: 6.2 Embedded Object Detection via IoT Hardware Module

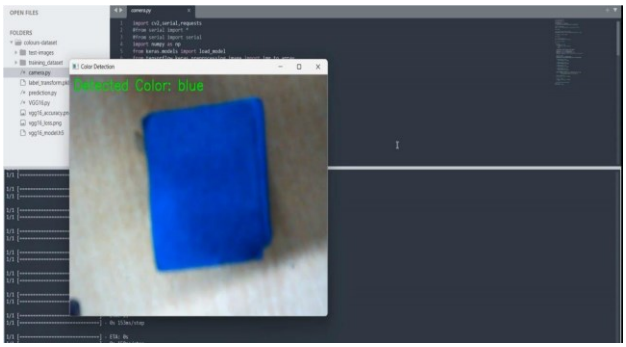

Fig 6.3 Object Detection Output on Host Machine Interface

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Fig 6.4 Secure Authentication Interface of the IoT Server

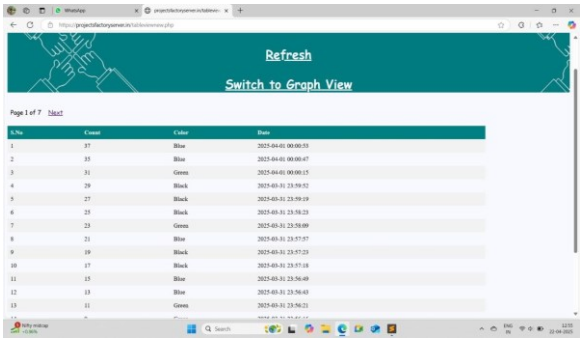

Fig 6.5 Data Logging and Storage Structure on IoT Backend Server

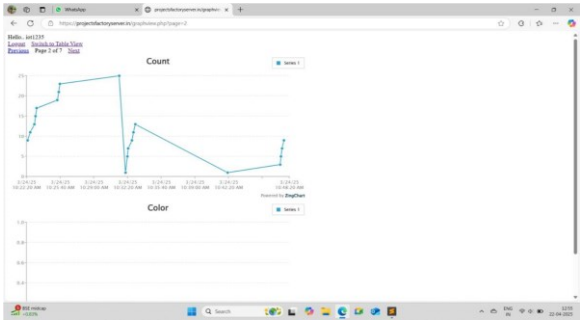

Fig 6.6 Evaluation of System Accuracy and Performance Metrics

VII.CONCLUSION

In conclusion, the development of an automated color based object sorting system represents a significant advancement in industrial automation. Color, being a primary distinguishing characteristic, is critical in numerous industries for classifying and managing products. Manual sorting based on color is not only labor intensive but also prone to human error, inefficiency, and inconsistency, especially when performed on a large scale. This highlights the urgent need for a reliable and automated solution that minimizes human involvement while maximizing productivity and accuracy. The proposed system effectively addresses these challenges by leveraging the capabilities of Raspberry Pi as the core controller and integrating it with IBM Watson Studio's visual recognition model for accurate color detection. The combination of hardware and deep learning based image processing enables the system to detect the color of an object, process the information, and actuate the appropriate sorting mechanism in real time. The inclusion of a feeder ensures the continuous flow of objects, contributing to a streamlined and efficient sorting process. By automating the color sorting process, the system reduces labor costs, speeds up production lines, and ensures consistent sorting quality. It also offers scalability and flexibility, making it adaptable for various industrial applications. Moreover, the open source nature of the Raspberry Pi platform makes the solution cost effective and

customizable for future enhancements, such as sorting based on shape, size, or texture, as well as integration with IoT based monitoring and control systems. Ultimately, this automated system not only simplifies the sorting task but also represents a forward thinking approach to industrial innovation. It showcases how the integration of machine learning, image recognition, and embedded systems can transform traditional processes into intelligent and autonomous operations.

VIII.FUTURE SCOPE

1. Integration with Advanced AI Models: The system can be upgraded by incorporating more advanced machine learning and deep learning models for better color recognition accuracy, especially in environments with variable lighting or overlapping objects.

2. Multi Feature Sorting Capability: In addition to color, the system can be enhanced to sort objects based on other parameters such as shape, size, and texture using advanced image processing and AI techniques, making it more versatile for industrial applications.

3. High Speed Processing with Edge AI: Deploying edge AI hardware like NVIDIA Jetson Nano or Google Coral along with Raspberry Pi can drastically improve processing speed and enable real time decision making for high speed conveyor belts.

4. Adaptive Lighting System: Incorporating an intelligent lighting system that adjusts brightness and color temperature based on the object's surface can enhance color detection reliability and reduce false classifications.

5. Cloud Connectivity and Data Analytics: Connecting the system to cloud platforms for real time monitoring, logging, and analysis of sorting data can provide insights for optimization, maintenance prediction, and quality control.

6. Robotic Arm Integration: Instead of channeling objects using motors, robotic arms can be employed for more precise and flexible object placement, especially for fragile or irregularly shaped items.

7. Scalability for Industrial Use: Enhancing the design for modular scalability can allow multiple units to work in sync, making it suitable for large scale industrial environments with higher throughput requirements.

8. Voice and Gesture Control for System Configuration: Implementing voice or gesture recognition using modules like Google Assistant or vision based gesture

control could provide an intuitive way to interact with the system for configuration and diagnostics.

IX.REFERENCES

1. IBM Corporation. IBM Watson Visual Recognition. IBM Watson Studio. Available at:[https://www.ibm.com/watson/services/visualrecognition/](https://www.ibm.com/watson/services/visual recognition/)

2. Raspberry Pi Foundation. Raspberry Pi Documentation. Available at: https://www.raspberrypi.org/documentation/

3. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.

4. Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.

5. Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson Education.

6. Ponce, J., & Forsyth, D. A. (2011). Computer Vision: A Modern Approach (2nd ed.). Pearson.

7. Jain, A. K., Duin, R. P. W., & Mao, J. (2000). "Statistical Pattern Recognition: A Review". IEEE Transactions on Pattern Analysis and Machine Intelligence, 22(1), 4 37.

8. Automation World. (2021). The Role of Automation in Modern Manufacturing. Available at: https://www.automationworld.com