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Development of an Automatic Counting and Sorting Machine Using a Microcontroller

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Abstract

The sorting of different products has been reported to be a very tedious industrial process, complex and a global problem. Manual sorting creates consistency issues and involves a lot of manpower with reduced efficiency and accuracy. This study presents an automatic sorting and counting device using an LGT8F328 microcontroller. The device uses a TCS320 RGB colour sensor, two servo motors and a serial terminal used to display the data read from the colour sensor. The circuit was simulated using Proteus ver8.2, and the prototype was developed and tested for sensitivity, specificity and accuracy. Results show that the device sensitivity is 96.72%, specificity 95.08% and accuracy 95.90%. This implies that the device can accurately count and sort out 96.72% of colours but will fail to identify 3.28% of the same. Also, the device's accuracy of 95.90% implies that counting and sorting using this device conforms to the standard, and we are 95.9% sure. This work holds some significant advantages and benefits across various industrial applications, such as efficiency and accuracy, time and labour saving, consistency and reliability, versatility, customisation and reduced human intervention. It is very useful in a wide variety of industries, along with the help of a Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) system, especially in the packaging section. An automatic sorting machine enhances efficiency, practicality, and safety of operators. It ensures remarkable processing capacity.

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Keywords: Counting and sorting; colour sensor; simulation; microcontroller; automation.

1. Introduction

Sorting activities involve the identification of items possessing specific characteristics within a mixed material stream, followed by their separation from the remaining flow. A key challenge associated with such processes lies in achieving reliable and efficient sorting performance (Lucchese *et al.,* 2023). Colour-based sorting is widely employed across various industries to ensure consistent product quality and compliance with required standards (Cello *et al.,* 2026). In this context, industrial processes have been substantially refined through the adoption of automated systems, largely owing to the limitations inherent in manual sorting approaches (Bayoumi, 2022; Jackvony & Jouaneh, 2024; Bogue, 2017; Abbood *et al,* 2020). The manual system of sorting objects is based on manpower. Humans are highly capable to differentiate objects colours and sorting them. But repeating the same process may cause irritation and mental stress, which can lead to certain manual errors such as low accuracy, low efficiency, etc. (Yang, 2022; Nuva *et al*, 2022; Umaru *et al*, 2025; Sun, 2016).

Manufacturing has undergone profound transformation over the past century, progressing from manual craftsmanship to mass production and, more recently, to highly automated and technologically advanced systems (Chukwunweike *et al.,* 2024). Although human involvement remains integral to many production processes, it is inherently prone to error, which can result in substantial financial losses for companies due to variability in product output. In certain sectors, such as retail and manufacturing, this may lead to inventory loss and reduced profitability, while in critical fields such as healthcare and pharmaceuticals, such errors may have life-threatening consequences. Approximately 30% of quality defects have been attributed to human error, yet investigations into their root causes are often inadequate and superficial (Shinde *et al*, 2021; Wang et al., 2022). Moreover, sustainable corrective and preventive actions (CAPAs) are frequently lacking, with remedial measures commonly limited to retraining. However, such an approach is often insufficient, as training addresses primarily deficiencies in knowledge, skill, or competence and is estimated to account for only around 10% of human error occurrences (Bayoumi, 2022; Vidya & Suresha, 2017; Pamungkas *et al*, 2025). Consequently, in order to reduce production time and enhance product quality, there has been a growing shift towards the implementation of automated systems (Oladapo, 2016; Bogue, 2017; Yang, 2022).

Automation has been realised through a range of technological means, including mechanical, hydraulic, pneumatic, electrical, electronic systems, and computer-based control, typically employed in integrated combinations. The advantages of automation encompass reductions in labour requirements, lower energy consumption costs, decreased material wastage, and significant improvements in product quality, accuracy, and precision (Dezaki *et al*., 2022; Kunhimohammed *et al*, 2014; Kshirsagar, 2023). The developed and industrialised nations have started using automation in production due to technological advancement and capital adequacy. It is globally recognised that automation can significantly increase industrial production while reducing production costs by up to 40% (Islam, 2023). In today's competitive landscape, product efficiency is paramount for success, encompassing aspects such as production speed, cost reduction (both material and labour), quality enhancement, and decreased rejection rates (Dhiman, 2019; Kshirsagar, 2023; Chovanec *et al*, 2022). Automatic sorting of products has emerged as a complex and pervasive challenge across various industries, including the diamond, food, and metal sectors (Kheman *et al.,* 2023; Jackvony & Jouaneh, 2024). The traditional manual sorting processes are labour-intensive and prone to inconsistency, often requiring significant manpower and leading to operational inefficiencies (Yang, 2022; Umaru *et al*, 2025).

Moreover, the current industry practices lack effective solutions that integrate advanced technology to enhance sorting accuracy and efficiency. Therefore, to address the specific limitations of existing methods, the objective of this research is to fill this gap by developing a prototype of an automated counting and sorting system that automatically separates products based on their colours using an LGT8F328 microcontroller. The proposed system is able to sense, sort and count objects based on their colours and to display them on an LCD display. It transfers the different coloured objects to different containers according to their colour indication, thereby improving operational efficiency and accuracy in product sorting.

2. Materials and Method

2.1 Materials

These components can be broadly categorised into mechanical, electrical, and software components. The materials used are listed in Table 1.

Table 1. Materials and their specifications

S/No	Category	Material	QTY	Specification
1.	**Mechanical**	Servo Motor	1	Dotted type
2.		Construction Wire	4yrds	330Ω
3.		Flexible Wire	3	1kΩ5.1v
4.		Hot Glue	4	LM7805
5.		PVC Plastic	1	AC to 12V DC
6.	**Electrical**	Microcontroller Board	1	LGT8F328
7.		LED	1row	Dotted type
8.		Sensor	3yrds	TCS320
9.		Header Pins	3yrds	Tiny thick
10.		Resistor	1	330Ω, 1kΩ
11.		Zener Diode	1	5.1v, 9.1v
12.		Polarized Capacitor	2	100nF, 1N4007
13.		Non-Polarized Capacitor	2	Red
14.		Rectifier Diode	2	Micro Servo
15.		Linear Voltage Regulators	5	LM7805, LM7809
16.		LCD	1	Character
17.		Power Supply Module	1	220v
18.	**Software**	Microcontroller Firmware	1	(implied)

2.2 Methods

2.2.1 Hardware Construction Method

The construction of the digital counting and sorting machine was carried out according to the block diagram shown in Fig. 1. The block diagram has three segments, which are: The Power supply, Control mechanism and Servo motor.

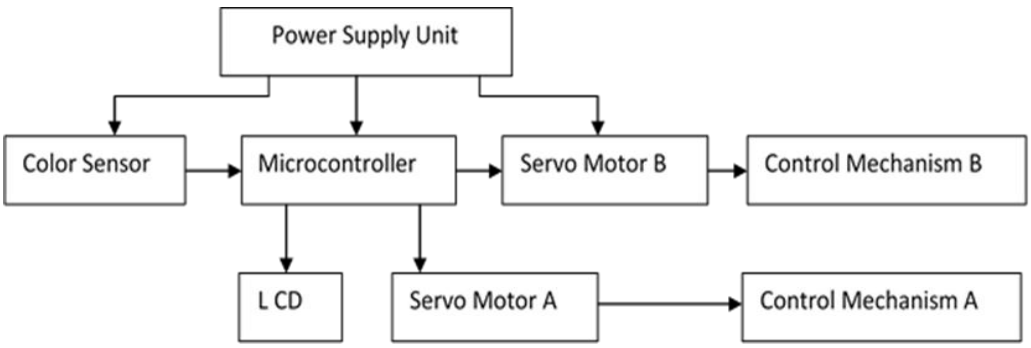

Fig. 1. Block diagram of automatic counting and sorting machine with digital display

These methods encompass a wide range of activities, from basic soldering and wiring to more advanced techniques like surface mount technology (SMT) and printed circuit board (PCB) design and manufacturing.

Soldering: Soldering is a fundamental technique in hardware construction, involving the melting of a metal alloy (solder) to join two or more electrical conductors. It is commonly used to connect wires, components, and terminals on PCBs.

Crimping: Crimping is a method of connecting wires and terminals using specialised crimping tools. It creates a secure and reliable connection by deforming a metal sleeve around the conductors.

Wire Wrapping: Wire wrapping involves wrapping insulated wire around metal posts or terminals. It is a versatile method for prototyping and breadboarding circuits, allowing for easy modifications and changes.

Surface Mount Technology (SMT): SMT is a modern method for assembling electronic components directly onto the surface of a PCB. It eliminates the need for through-hole components, resulting in smaller, lighter, and more densely populated PCBs.

Encapsulation and Protection: Once hardware components are assembled, they may require encapsulation or protection to ensure their durability and prevent damage from environmental factors. This may involve using conformal coatings, potting compounds, or protective enclosures.

Testing and Quality Assurance: Hardware construction methods must incorporate rigorous testing and quality assurance procedures to ensure the functionality and reliability of the assembled devices or systems. This may involve visual inspection, electrical testing, and environmental testing.

Power 'On' Test: This test was performed to verify that the voltages at various terminals conformed to the specified requirements. This procedure was conducted without the microcontroller in place, in order to prevent potential damage arising from excessive voltage levels or thermal stress (Alaameri *et al,* 2024). Following Almtireen *et al*. (2025) and Medojević *et al*. (2022), a multimeter was configured in voltage measurement mode. Initially, the output of the power supply was verified to confirm the presence of a 12 V DC supply, which was then applied to the input of the voltage regulator. The input and output terminals of the voltage regulator were subsequently examined, yielding measured values of 12 V DC at the input and 5 V DC at the output. The regulated 5 V DC output was used to power the microcontroller via pin 40. Voltage levels at pin 40 and other relevant terminals were also assessed to ensure compliance with specified requirements, as the same 5 V DC (VCC) supply was utilised for both the microcontroller and the associated sensors.

2.2.2 Software Design Method

Insertion sort is a simple sorting algorithm that works by inserting each element into its correct position in the sorted array. The algorithm works by comparing the current element to the element to its left, and shifting the elements to the right until the current element is in its correct position. Following the work of Raju *et al*. (2023), the design of a sorting machine is typically done by performing the following four basic steps.

1. **Define the Input and Output:** The first step is to define the input and output of the sorting machine. What type of data will the machine be sorting? What is the desired output format?
2. **Choose a Sorting Algorithm:** There are many different sorting algorithms available, each with its own strengths and weaknesses. Some common sorting algorithms include insertion sort, bubble sort, merge sort, and quicksort. The best algorithm for a particular application will depend on the specific requirements of the application.
3. **Design the Hardware:** Once the sorting algorithm has been chosen, the next step is to design the hardware for the sorting machine. This will involve designing the components that will perform the sorting operation, as well as the components that will control the machine.
4. **Write the Software:** The final step is to write the software for the sorting machine. This will involve writing the code that will control the machine and implement the sorting algorithm.

Algorithm: The sorting algorithm for this study is as follows:

1. Start
2. Include libraries and initialise the system variables
3. Set the date and time
4. Read all the sensors
5. Display data on LCD
6. Check the color
7. If the colour is red, separate to the red container; if not, continue
8. If the colour is green, separate to the green container; if not, continue
9. If the colour is blue, separate to the blue container; if not, continue
10. Repeat the process
11. Stop

Choice of Programming Language: The programming language used in this study is Arduino C. This is a simplified variant of C++ tailored for the Arduino programming platform. It provides an easy-to-use environment for programming Arduino microcontrollers, making it a good choice for beginners or projects with limited hardware complexity. The Flowchart is shown in Fig. 2. The stage and process description of the automatic counting and sorting machine includes:

i. **Initialisation:** The system starts, clears the digital display, and calibrates the sensors.
ii. **Detection:** An IR sensor or proximity sensor waits at the entry point to detect when an object is fed into the machine.
iii. **Classification:** Sensors (like colour sensors, inductive sensors for metal, or optical sensors for size) identify the item's type.
iv. **Sorting Action:** The microcontroller (e.g., Arduino or PLC) sends a signal to an actuator (a servo motor or pneumatic arm) to push the item into its correct position.

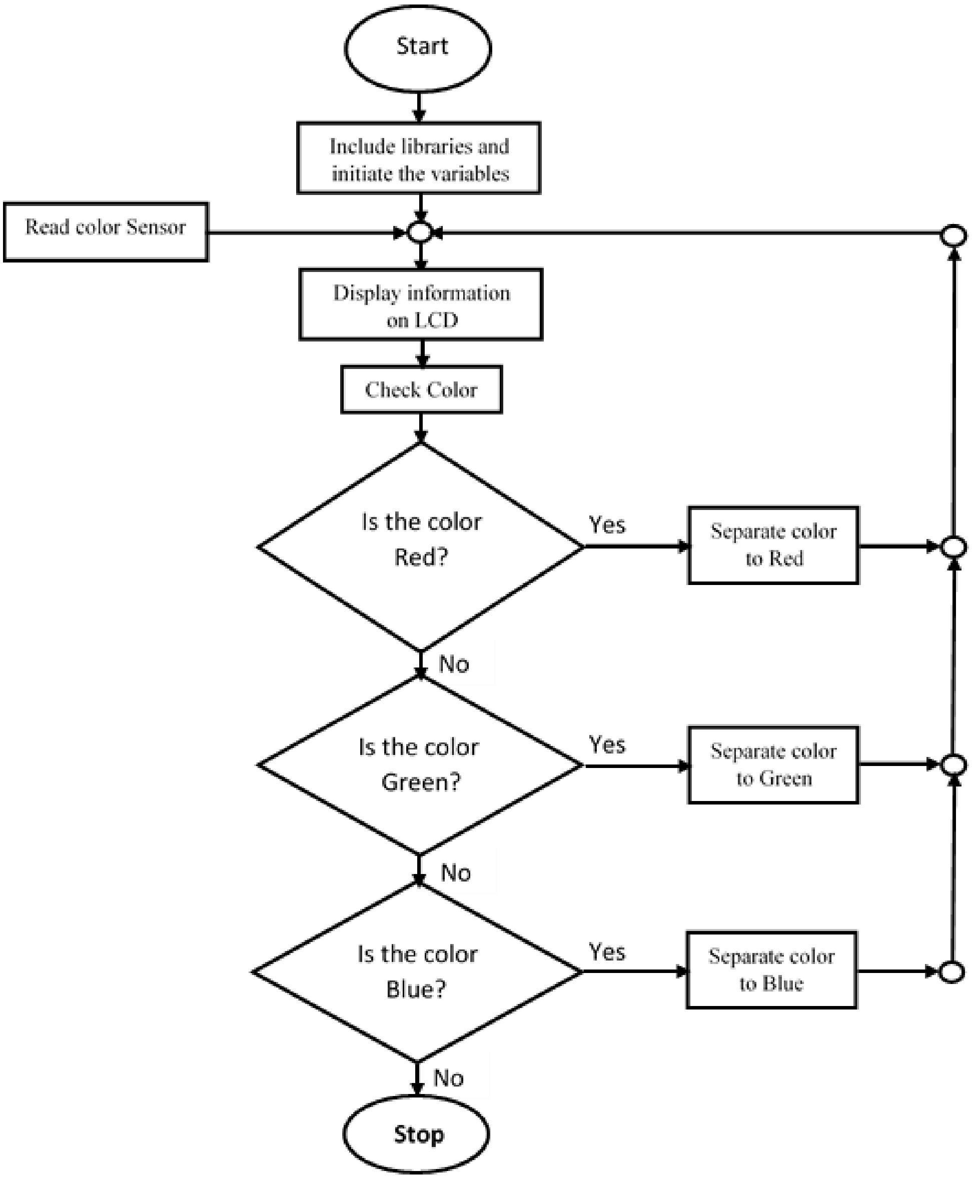

Fig. 2. Flowchart of automatic counting and sorting machine with digital display

2.2.3 Performance Evaluation Test

This test was performed to evaluate the prototype functionality to assess how successful is worth. The response of the system should be in line with the design. The evaluation test was achieved using the "Gold Standard" relation.

True Positive (TP): The number of times counting and sorting colours are correctly detected by the system.

False Negative (FN): The number of times counting and sorting colours are wrongly undetected by the system.

True Negative (TN): The number of times counting and sorting colours are correctly undetected by the system.

False Positive (FP): The number of times counting and sorting colours are wrongly detected by the system.

The values obtained from the test results were used to calculate the Sensitivity (S_e), Specificity (S_p) and accuracy (A_{cc}) of the device as:

Sensitivity (S_e): This is the ability of the system to correctly detect the colour and for correct counting around the unit and can be calculated as follows:

$$S_e \frac{TP}{TP+FN} = \text{x } 100 \tag{1}$$

Specificity (S_p): This is the ability of the device to correctly reject a colour around the unit and can be calculated as follows:

$$S_p = \frac{TN}{TP+FP} \text{ x } 100 \tag{2}$$

Accuracy (A_{cc}): This is the extent to which the results of measurement, calculation or specification conform to the correct or standard value, and it is calculated as follows:

$$A_{cc} = \frac{TP}{TP+TN+FP} \text{ x } 100 \tag{3}$$

3. Results

3.1 Simulation Results

The simulation was carried out in stages in line with the block diagram shown in Fig. 1, and the results are presented in Figs. 3 to 8.

3.2 Construction Result

The circuit was initially constructed on a breadboard to verify correct operation and ensure that the design met the required specifications before final implementation. It was subsequently transferred to a printed circuit board (PCB) for permanent soldering. The microcontroller and the Arduino Uno functioned as key system components, while the colour sensor, liquid crystal display (LCD), relay unit, and all other components were interfaced with the microcontroller and Arduino board. Care was taken to minimise the use of excessive solder (lead-based material) during assembly in order to avoid clutter and prevent unintended bridging between adjacent components. The constructed circuit of the device is as shown in Fig. 9, while Fig. 10 is the top view of the finished product.

3.3 Performance Evaluation Test

The performance evaluation test was carried out to ascertain the functionality of the constructed device. The device was tested for low/high levels of colour sorting. An average of three color were tested for verifying the degree of colour sorting. Table 2 presents the evaluation performance result for the test carried out by sorting and counting 20 times each of the colours.

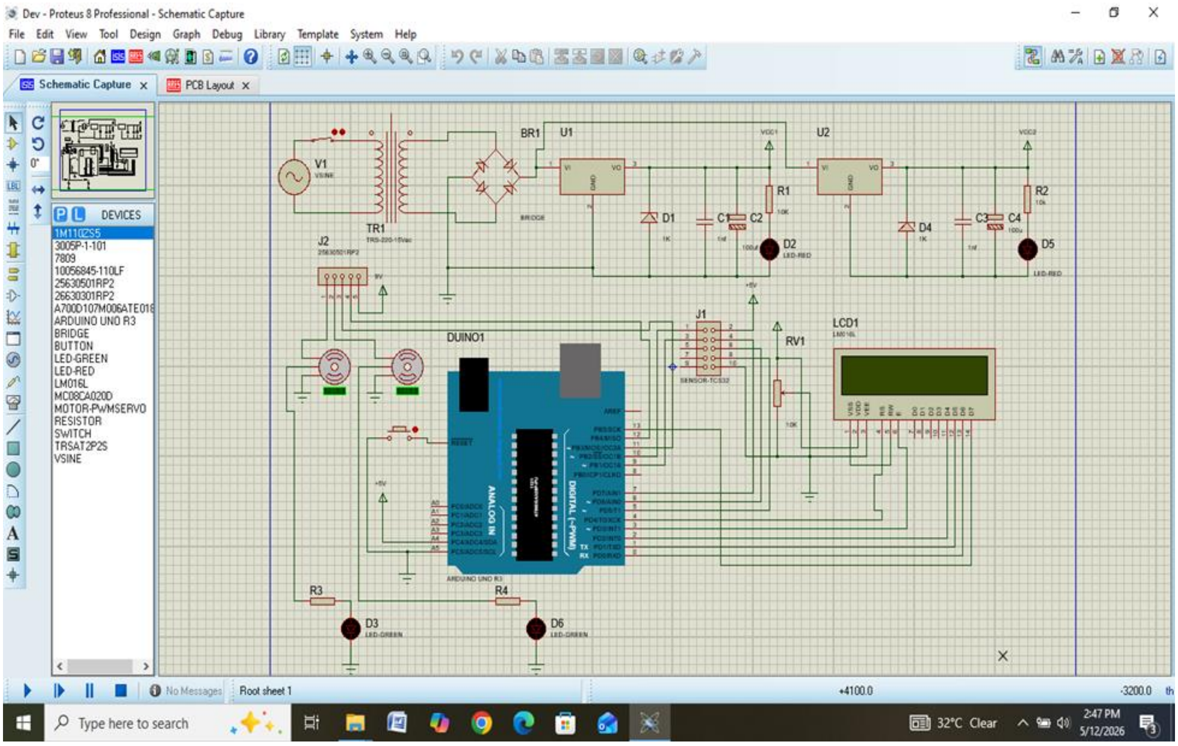

Fig. 3. Simulated General Circuit Diagram

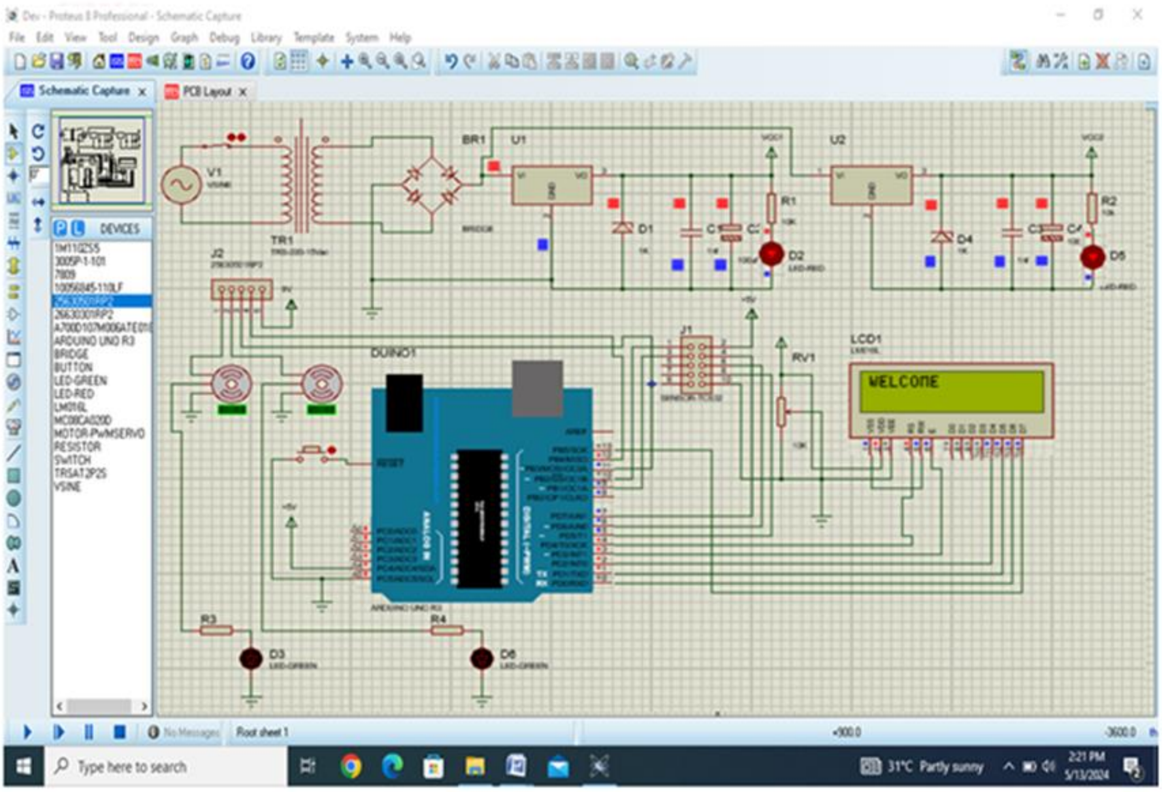

Fig. 4. Simulated circuit initialisation stage (”Welcome stage”)

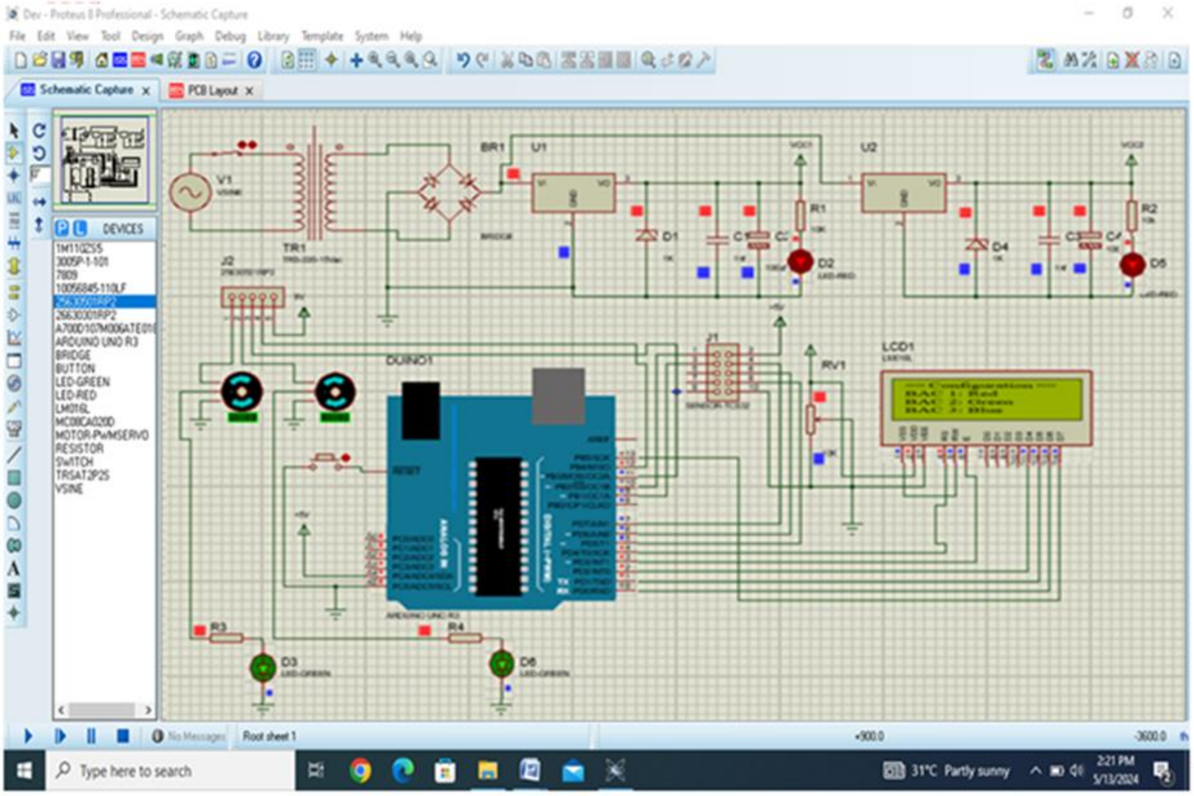

Fig. 5. Simulation result showing configuration stage

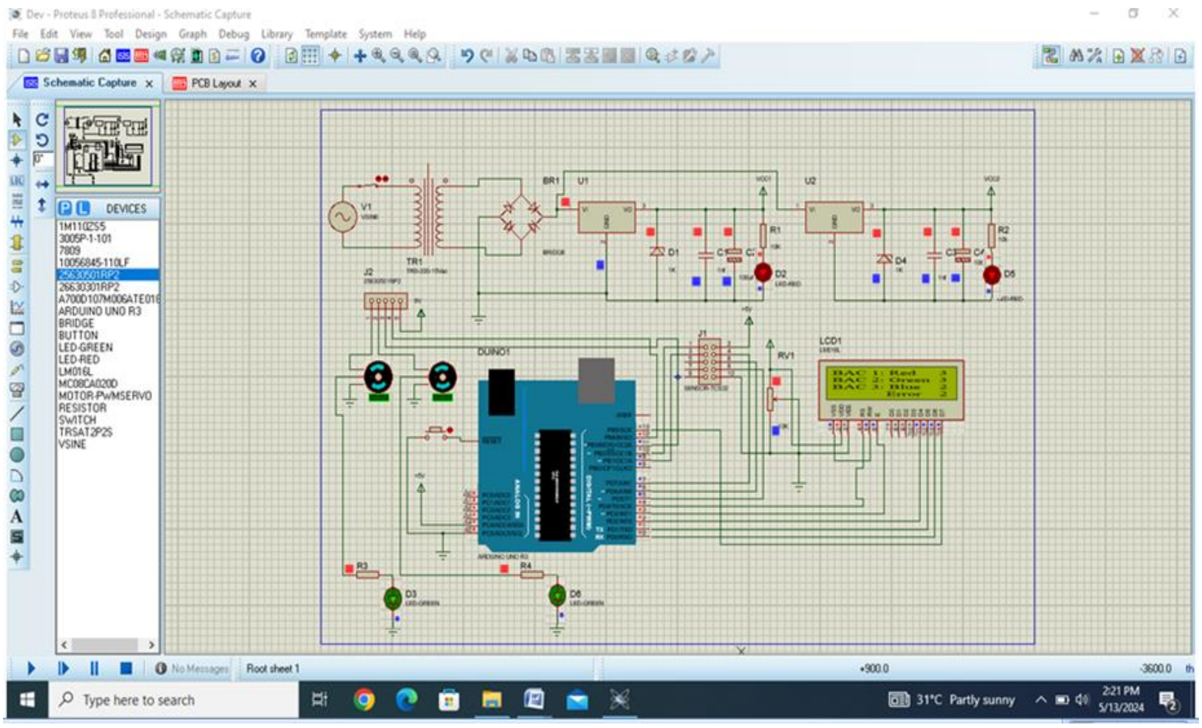

Fig. 6. Simulated result showing counting stage

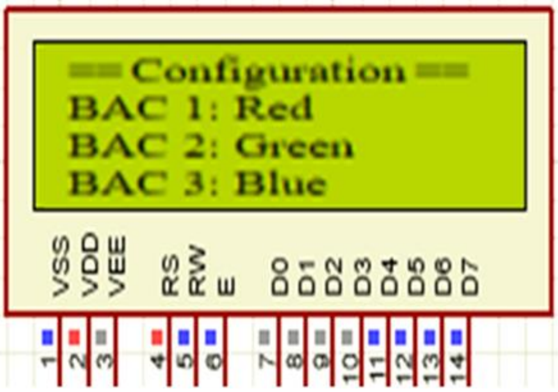

Fig. 7. LCD displaying configured parameters

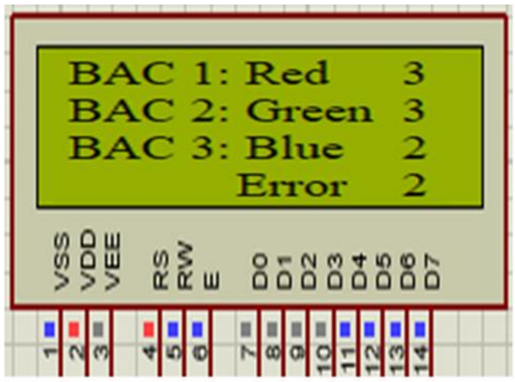

Fig. 8. LCD at counting stage

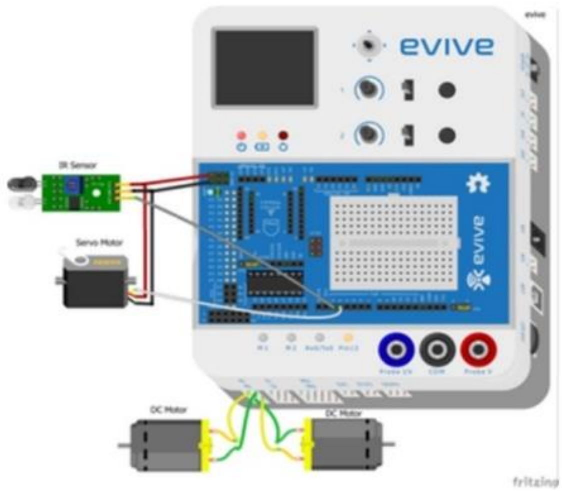

Fig. 9. Colour sorting machine prototype

Fig. 10. Top view of device

Table 2. Performance Evaluation Result

S/No	SENS	No of trial	True Position (TP)	False Negative (FN)	True Negative (TN)	False Positive (FP)
1.	Red	20	20	0	19	1
2.	Green	20	19	1	19	1
3.	Blue	20	20	1	20	1
	Total	60	59	2	58	3

The results from Table 2 were used to calculate the specificity, sensitivity and accuracy using Equations (1) to (3) as:

$$S_e = \frac{Tp}{TP + FN} \times 100 = \frac{59}{59{+}2} \times 100 = 96.72\%$$

$$S_P = \frac{TN}{TN + FP} \times 100 = \frac{58}{58{+}3} \times 100 = 95.08\%$$

$$A_{cc} = \frac{TP + TN}{TP + FN + TP + FP} \times 100 = \frac{59 + 58}{59 + 2 + 58 + 3} \times 100 = \frac{117}{122} \times 100 = 95.90\%$$

4. Discussion

The constructed colour sorting machine, when subjected to a series of colour-based tests, yielded essential results confirming its operational functionality. The continuity test indicated that the circuit was intact, with no evidence of short circuits, broken conductors, damaged components, or excessive resistance along the connection pathways. Furthermore, the power-on test demonstrated that the voltages at various terminals conformed to the specified requirements of the simulated circuit. These findings are consistent with those reported by Pamungkas *et al*. (2025), Aung and Zar (2019), and Abbood *et al*. (2020).

Findings from the performance analysis on the device revealed that the sensitivity is 96.72% while specificity is 95.08%. This implies that the constructed system will correctly detect 96.72% of colour around the unit. The device will also correctly identify 96.72% of colour but will fail to identify 3.28% of the same. The accuracy of the device has been calculated to be 95.90%. That is, the constructed device conforms to the corrected value of the simulated circuit. This implies that the objective of using the device for accurate colour sorting is possible, and we are 95.9% sure. Both results of colour sorting level (low/high) and colour reading are displayed on the LCD. This shows optimal performance of the device. However, of all the previous work reviewed, none of the similar works were able to calculate specificity, sensitivity and accuracy which forms the novelty and contribution of this study to the literature, but the result on construction and testing of the device were in line with previous work carriedout such as Dezaki *et al*. (2022), Aung and Zar (2019) and Baek *et al.* (2011).

5. Conclusion

Sorting of products in a factory is a mandatory industrial process that must be carried out regularly to ensure that the same products are packaged accordingly. Continuous manual sorting often leads to operational inefficiencies and consistency issues. This study presents a functional prototype developed for the automatic sorting of objects based on colour. A TCS230 colour sensor was employed for detecting the colour of products, while an LGT8F328P microcontroller unit was used to manage and coordinate the overall system operation. Colour identification was achieved through frequency analysis of the output signal from the TCS230 sensor. Two mechanical object shifters, each driven by independent servo motors, were incorporated into the system. The first shifter positions the object for colour sensing, whereas the second directs the object to the appropriate compartment within a multi-section collection unit, thereby enabling effective segregation of items. Experimental findings indicate that the prototype is capable of meeting the requirements of high-throughput production environments while maintaining precision in automated processing applications.

The system demonstrates reliable performance in sorting objects according to their respective colours and may be regarded as an intelligent colour sorting solution applicable across a wide range of industrial sectors, including packaging, particularly when integrated with PLC and SCADA systems. The automation of the sorting process enhances operational efficiency, practicality, and operator safety, while also delivering improved processing capacity and accurate colour discrimination. Further improvements to the system may include the integration of cameras at the sensing stage, coupled with image processing techniques to enhance classification accuracy and provide additional object-related information. Additionally, the incorporation of load cells could enable the measurement of object weight, thereby extending the system's functionality.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

References

Abbood, W. T., Abdullah, O. I. & Khalid, E. A. (2020). A Real-Time Automated Sorting of Robotic Vision System Based on the Interactive Design Approach. *International Journal on Interactive Design and Manufacturing*, 14(1), 201–209. https://doi.org/10.1007/s12008-019-00628-w

Alaameri, K. J., Ramadhan, A. J., Fatlawi, A., & Idan, Z. S. (2024). Design of a New Sorting Colors System Based on PLC, TIA Portal, and Factory I/O Programs. *International Journal of Innovative Science and Research Technology*, 14(1). 1409-1412. https://doi.org/10.1515/eng-2022-0547

Almtireen, N., Reddy, V., Sutton, M., Nedvidek, A., Karn, C., Ryalat, M., Elmoaqet, H. & Rawashdeh, N. (2025). PLC-Controlled Intelligent Conveyor System with AI-Enhanced Vision for Efficient Waste

Sorting. *International Journal of Logistics Research and Applications*, 15(3), 15-50. https://doi.org/10.3390/app15031550

Aung, T. M., & Zar, K. (2019). Automated color sorting system using Arduino. *International Journal of Advanced Research in Computer Science and Software Engineering*, *9*(3), 23–30. https://doi.org/10.23956/ijarcsse.v9i3.908

Baek, I., Cho, B. K., & Kim, Y. S. (2011). Development of a compact quality sorting machine for cherry tomatoes based on real-time color image processing. *Journal of Biosystems Engineering, 36*(6), 433-440. https://doi.org/10.5307/JBE.2011.36.6.433

Bayoumi, A. S. (2022). Vision-Based Mechatronic System for Classification and Sorting Colored Objects. *International Undergraduate Research Conference*, 6(6), 1–5. https://doi.org/10.21608/iugrc.2022.303237

Bogue, R. (2017). Robots that interact with humans: a review of safety technologies and standards. *Industrial Robot: An International Journal, 44*(4), 395-400. https://doi.org/10.1108/IR-04-2017-0070

Cello, J. M., Go, M. W. F., Nacional, L. B., Onia, G. C. G., Siervo, J. G. N., & Fabro, B. C. (2026). Automated color-based object sorting system: Design and implementation using Arduino. *International Journal of Research and Innovation in Social Science*, *10*(1), 1738–1749. https://doi.org/10.47772/ijriss.2026.10100142

Chovanec, L., Duong Quang, K., Vuong Thi, H., Ngo Thi, L., Nguyen Thi, N., Tran Duy, D., Nguyen Thai, S. & Pham Hai, L. (2022). Model Design of Automatic Defective Product Sorting System. *Journal of Science and Transport Technology*, 2(4), 20–25. https://doi.org/10.58845/jstt.utt.2022.en.2.4.20-25

Chukwunweike, J., Anang, A. N., Adeniran, A. A., & Dike, J. (2024). Enhancing manufacturing efficiency and quality through automation and deep learning: Addressing redundancy, defects, vibration analysis, and material strength optimization. *World Journal of Advanced Research and Reviews*, *23*.

Dezaki, M. L., Hatami, S., Zolfagharian, A. & Bodaghi, M. (2022). A Pneumatic Conveyor Robot for Color Detection and Sorting: Cognitive Robotics. *International journal of modern trends in engineering and research,* 2(5), 60–72. https://doi.org/10.1016/j.cogr.2022.03.001

Dhiman, R., Singh, M., Munish, M., Malhi, G. S. & Jaswanti, J. (2019). A Review of Automatic Color Sorting Machine Using IR Sensor and Arduino. *International Journal of Precious Engineering Research and Applications*, 4(2), 15–19.

Islam, M. M. (2023). Determinants of industrial automation adoption in Bangladesh's manufacturing: An empirical study. *Journal of Economics, Management and Trade*, *29*(11), 114–123. https://doi.org/10.9734/jemt/2023/v29i111167

Jackvony, B. & Jouaneh, M. (2024). Building an Educational Automated Mechatronics-Based Sorting System. Automation. *Engineering Science and Technology, an International Journal* 5(3), 297–309.

Kheman, S., Ramthirth, P. S., Chavan, S., Kaddaragi, S. D. & Kulkarni, V. R. (2023). Design and Development of an Automatic Color Sorting Machine on Belt Conveyor. *International Journal of Research in Engineering, Science and Management,* 6(6), 15–17.

Kshirsagar, K. P., Kamble, D. A., Tamkhade, J. P., Mirajkar, R. R., Shingvi, L., Oswal, C., Patwa, V. & Shingvi, M. P. (2023). Automatic Sorting Machine Using PLC and HMI Technique. *International Journal on Recent and Innovation Trends in Computing and Communication*, 11(10), 678–683. https://doi.org/10.17762/ijritcc.v11i10.8563

Kunhimohammed, C. K., Saifudeen, K. K. M., Sahna, S., Gokul, M. S. & Abdulla, S. U. (2014). Automatic Color Sorting Machine Using TCS230 Color Sensor and PIC Microcontroller. *International Journal of Research and Innovations in Science and Technology*, 2(2), 33–38.

Lucchese, A., Digiesi, S., & Mummolo, G. (2023). Human performance of manual sorting: A stochastic analytical model. In *International Joint Conference on Industrial Engineering and Operations Management* (pp. 445–456). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-16400-2_35

Medojević, I., Veg, E., Joksimović, A. & Ilić, J. (2022). Promotion of Color Sorting in Industrial Systems Using a Deep Learning Algorithm. *Journal of Selected Topics in Signal Processing*, 12(24). 12817. https://doi.org/10.3390/app122412817

Nuva, T. J., Ahmed, M. I., & Safat, S. (2022). Design and Fabrication of Automatic Color and Weight-Based Sorting System on Conveyor Belt. *Journal of Integrated and Advanced Engineering*, 2(2), 147–157. https://doi.org/10.51662/jiae.v2i2.87

Oladapo, B. I. (2016). Model Design and Simulation of Automatic Sorting Machine Using Proximity Sensor. *Engineering Science and Technology, an International Journal,* 19(3), 1452–1459.

Pamungkas, D. S., Saputra, S. & Pelmelay, A. A. (2025). Design and Evaluation of Automatic Sorting System Using YOLO v5 Object Detection and PLC Control. *Journal of Applied Computer Science and Technology*, 6(1). https://doi.org/10.52158/jacost.v6i1.1165

Raju, S. R., Kumar, P., & Ramesh, B. (2023). Development of a Color-Code Sorting Machine Operating with Pneumatic and Programmable Logic Control. *Journal of Network and Computer Applications*, 1(4), 2500–2506. https://doi.org/10.1016/j.matpr.2023.05.150

Shinde, K., Adulkar, V., Wankhede, A. & Perla, M. (2021). IOT Based Automatic Colour Sorting Machine. *VIVA Institute Journal of Research and Innovation*, 1(4), 1–6.

Sun, D. W. (2016). *Computer Vision Technology for Food Quality Evaluation* (2nd ed.). Wiley, New Jersey, USA, 22, 56, 233-270.

Umaru, K., Marlon, M., Nansukusa, Y., Ritah, N. & Zaina, K. (2025). PLC Based Speed Control in a Color Sorting System: A Design and Simulation Perspective. *Journal of Engineering, Technology & Applied Science*, 7(1), 37–51.

Vidya, V. V. & Suresha, D. (2017). Automated Color Based Object Sorting for Quality Control. *International Journal of Engineering Research & Technology (IJERT),* 37(3), 789–795.

Wang, Q., Cao, S. & Chen, X. (2022). The Design of Material Conveying and Automatic Sorting Control System Based on PLC. *Proceedings of the International Conference on Artificial Life and Robotics*, 27, 1085–1088. https://doi.org/10.5954/ICAROB.2022.OS12-7

Yang, X. (2022). Research on Automatic Sorting Device Integrating Machine Vision and PLC. *Journal of Agricultural Mechanization Research*, 44(2), 237–240. https://doi.org/10.13427/j.cnki.njyi.2022.02.043

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