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PROJECT REPORT

TITLE : DESIGN AND DEVELOPMENT OF OBJECT SORTING SYSTEM

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DECLARATION

We hereby declare that the Project report entitled “Design and development of object sorting system” has been written by us as part of our coursework during the Fall Semester 2020-21 under the guidance of Dr. Sriharipriya K C, Department of Electronics and Communication Engineering, Vellore Institute of Technology, Vellore. We further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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ABSTRACT

Sorting the enormous number of products in the market is the main task that must be completed in the final packaging sector in many industrial applications. In an industry, material sorting is a repetitive task that is often done by hand. However, there may be issues with output accuracy with this ongoing manual sorting process. Instead, by employing the TCS3200 colour sensor in our automatic sorting machine, these drawbacks of conventional packing may be eliminated in order to have an accurate product given to the market for the customers. With the aid of the Arduino, the system may be configured in accordance with the required work that has to be done in industries, and by employing the conveyor belt these things can be moved easily across the warehouse.

Keywords: Colour Sensor, Business process automation.

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AIM

- To interface TCS3200 colour sensor with Arduino Uno.
- To interface LCD screen with Arduino Uno
- To interface a servo motor with Arduino Uno
- To develop an object sorting algorithm to sort red, green, and blue object in a desired manner.
- To develop a code for the object sorting system in ARDUINO IDE software.

INTRODUCTION

The Internet of Things has brought all kinds of benefits to the world, big and small in our daily lives. It is understandable that IoT has become such an important part of our lives that our daily tasks have become much easier. With billions of physical devices currently connected to the internet in space around the world, IoT helps us collect and share all the information we need. The advantage of not-so-expensive computer chips and the ubiquity of cellular networks give us the amazing ability to turn the small pill-sized elements of the IoT into the giants of an airliner. A machine without artificial intelligence is futile, but connecting sensors to all these different objects will bring some degree of artificial intelligence to the machine, allowing these devices to process information in real time without human intervention.

IoT is evidently used in "smart homes," for instance. Thermostats, security cameras, door locks, smoke detectors, smart lights, alarm systems, and other devices are frequently installed in these homes. We have reached a point where it takes more time for humans to access equipment and carry out tasks by hand, but with the aid of these smart devices, tasks may be carried out automatically, saving both time and human effort.

By incorporating modern technologies, warehouses can now be turned from manual, time-consuming operations into intelligent ones. The enormous diversity of products, equipment, machines, and staff used in warehouse operations, where thousands of things are managed each day, is one of the main issues associated with warehouse functions. Additionally, the Internet of Things will enable the linking, tracking, and processing of infinite data points between devices through a central warehouse management structure.

LITERATURE REVIEW

There have been a few research works for object sorting system.

Farhana Hussain Altaf Hussain et al. [1] has proposed a system for sorting objects using TCS3200 sensor. With the help of the Arduino, the system can be programmed according to the work desired in industries. The servo pushes the object to a different conveyor that can move the object to different directions. It is more reliable and accurate.

Ahmad Rafiq Mohd Khairudin et al. [2] proposed a colour sorting robotic arm using the TCS3200 sensor which is controlled by a DC servo motor with a microcontroller-based system. An IoT platform is used to monitor the detection process, especially for counting each sorted colour block. Furthermore, the study also performs comparison between the robotic arm's indoor and outdoor efficiency.

Timothy Henry et al. [3] proposed a method for the design and construction of colour sensor based optical sorting machine. The components used are conveyor module, DC motor driver, colour sensor & cable, chute, sensor mounting, NPN to PNP converter, hopper feeder, DC motor, PLC, solenoid valve, and SysLink connector and ejector and waste bin holder,The capabilities of the final assembled and programmed machine were tested like colour identification, ejection, sorting etc.

A. F. Andi et al. [4] developed a system for determining the fruit ripeness sorting machine using TCS3200 colour sensor. The system will classify the colours of each fruit using the above sensor which will act as a colour detector . All these processes will be controlled using Arduino Uno with an ATmega328 microcontroller.

S. A. Ragul et al. [5] has proposed ,using urinalysis a non-invasive method of diagnosing health parameters .The urine test can be measured by pointing to the strip without the need for additional pad. A smart phone-based Android App has also been incorporated along with the device for diagnosing. The device measures the observed strip image in different colour spaces and uses colorimetric detection to deliver ten separate urine parameters. Here they used Arduino or Node MCU based non-invasive urinalysis system configuration and calculation using RGB TCS3200 sensor. The paper detects up to 10 parameters in patient's urine using urinanalysis helping in the diagnosis of their diseases.

Tonusree Mohanto et al. [6] has proposed a method to develop a 3DOF colour sorting based robotic arm with the help of MATLAB GUI. In this paper a robotic arm that has sorting abilities on the basis of colour through the TCS 230 colour sensor , has been developed. Kinematics and inverse kinematics approaches are used in this project. This model has proved the effectiveness and efficiency of the proposed model. The model is pocket-friendly and has high efficiency.

Ariagi Juliano et al. [7] has proposed an information system prototyping of strawberry maturity stages with the help of Arduino Uno and TCS3200. The design is able to display information about the maturity of strawberry fruit on the LCD display. The strawberry sorting on the WEB-Assisted Strawberry Maturity Sorting System series has worked effieciently and successfully.

Mark Seelye et al. [8] developed a pocket-friendly colour-sensor based system to monitor the amount of plant growth in a laboratory. The plant health status indicated through the help of an automated system for measuring plant leaf colour, has been developed for plantlets that grow in a modified micropropagation system. Sensors located on a pan and tilt system has used a robotic arm at the end of the arm for monitor ing plant growth , the ambient growing environment. This paper provides the calibration technique for RGB sensor and compares it with a high-end spectrophotometer.

Dhroov Batra et al. [9] had proposed an automated tomato sorting machine .For differentiating between ripe and unripe tomatoes , he has used two TCS3200 RGB colour sensor. The sorting of tomatoes as ripe and unripe is based on the colour force that has been caught by TCS3200 colour sensor. The precision was 93.33%. The execution has been evaluated for about1500 tomatoes for every 1 hour with at least 2 channels which can be expanded individually if both were utilized.

C. E. Ngene et al. [10] has used TCS3200 sensor for monitoring the total lifespan of LED colours in the traffic light and through the variation in frequency , yield it’s lifespan, incorporating them with a central network for the purpose of display. This experiment guarantees a steady traffic light for regulating the vehicles without any scope of accident in frost, high winds and rainingor any type of season.

Sandra et al. [11] has designed a digital image system for predicting tomatoes maturity with the help of a RGB digital image and vitamin C content database system for predicting the maturity of tomatoes.

Hendra Yufit Riskiawan et al. [12] found out the requirement of nitrogen fertilizer needed in a corn plant by using Colour Leaf Manual and measuring the green leaf level, using TCS3200 colour sensor and the Arduino Uno microcontroller.

Poltak Sihombing et al. [13] has developed project to sort citrus fruits with the help of RGB (Red, Green, Blue, RGB) colourmethod with the help of TCS3200 colour sensor and Arduino Uno Microcontroller for recognizing RGB colors of oranges. He has separated the fruits by the sensors depending on the colours of the fruit . After that , he has separated the citrus fruits depending on colour by the help of the actuator driven with the help of a servo motor.

Yongbo Chen et al. [14] has processed Chinese license plates in day-to day scenes by using a traditional methos of image processing algorithms and is successful in applying them in real scenes.

Eddy Nurraharjo et al. [15] helped children learn activities through colour-based creativity.

Z Inayah et al. [16] has used RGB digital image ,nitrogen content database system for predicting the nitrogen need for maize plants, he has used 40 leaves of maize plants with different ages like 15, 30 and 40 days and has proved that the device is able to the detect nitrogen content in the maize plants as per the above database with a success rate of 90%.

Humaidillah Kurniadi Wardana et al. [17] has made use of the urine in diabetes patients which is detected by sensor colours and measured the levels of colour which is based on the RGB colour of the urine samples. He has performed the experiment on 4 urine samples , each consisting of 3 diabetics and 1 non-diabetics patient.

K. Murali Chandra Babu et al. [18] performed the project "Design and Development of Cost-Effective Arduino based Object Sorting System".This project report is used as the base paper for our IOT project. In industrial applications, objects sorting is a tough task requireing continuous supply of labour. It is benefitcial to design a machine which can spot the objects and rearrange them in a particular order if a product matches certain predefined standards. This paper proposes to sort the objects by using colour identification with the help of TCS3200 sensor. The Identification of colour is based on the frequency analysis sensor output. Chutes has been used for placing the product for colour identification and to move the container. Arduino nano is used to control the process of sorting with colour identification. This system helps to sort coloured objects and also helped in differentiating the objects to a separate case.Implementation of the system and size scalability is cost-effective , making the designed system easy to implement in small industries , thus reducing the manual power.

Gregorio Imanuel Efraim Panie et al. [19] performed the project "Development of Robotic Arm for Colour Based Goods Sorter in Factory Using TCS3200 Sensor with a Web-Based Monitoring System". This system was made to increase the efficiency of calculation of goods manufactured manually. The issues can be solved by using a TCS3200 sensor which can identify the colour of goods . It's use will help to increase the productivity of companies. The development of colour sensor is described in this paper which is used to sort items by colour in the industrial world. Technology of this control system assisted in making IoT products, as well as the mechanical systems like robot arms consisting of four micro servos that are designed to pick up and put stuff in container. The result of the arithmetic processing of goods has been displayed through a Web page which has been designed. The achievement is using NodeMCU in programming sensor to sort various items , adjust in the container. It also includes a solution to colour sensor for recognizing colours through search algorithms.

Anna Karas et al. [20] performed the project "Automatic Colour Detection-Based Method Applied to Sentinel-1 SAR Images for Snow Avalanche Debris Monitoring". A novel method is developed in this study to automatically detect areas of snow avalanche debris using a colour space segmentation technique applied to synthetic aperture radar (SAR) image time series through January 2018 in the Swiss Alps. Debris avalanche zones are detected by assuming that these areas are marked by a significant and localized increase in SAR signal as compared to the surrounding environment. A sensitivity study is undertaken by calculating

debris products using varying the D-M reference images (a stable reference image taken several weeks before the event). The results are examined according to 1)the direction of the orbit, 2)the characteristics of the terrain (slope, altitude, orientation), and 3) by evaluating the relevance of the detection with the help of an independent SPOT database by Hafner and Buhler. Small avalanches are not detected through SAR images. Depending on the orientation of the terrain , some avalanches are not detected by either ascending or descending orbit. The detection results changes with the reference image; best detection results are found with some selected dates with almost 70% of verified avalanche events using ascending orbit.

Sarjana et al. [21] has oerformed the projeect "Coffee Groping Control System using TCS3200 Sensor Based on XBEE". This paper deals with a method of accelerating the use of TCS3200 sensors to quantize colours. It was performed using different images and it was provedf that the modifications have been able to show that the TCS3200 colour sensor is also very competitive due to the perfect colour quantization of images both in terms of effectiveness and efficiency. This system uses the pattern by knowing the coffee grouping control system through the wireless signal using. Here Module set to remote control with wireless network assisted, so the farmers have no problem controlling from close range. The database has been built for several coffee colours and comparison of shape has been made with a control system grouping mechanism, done with the help of servo motors, so that when the developed tool works it is going to be in line with the colour sensors that detect the colour of the coffee beans.

Farniwati Fattah et al. [22] have performed a project work on the topic "Measurement of Iodine Levels in Salt Using Colour Sensor". Iodine found in salt has different levels and it is important to know the iodine level consumed. Some types of salt do not provide information regarding the iodine content of the salt, but the others have levels that exceed human body consumption limit. The consumption limit of iodine is different in terms of age (children, adolescents, and adults), so it is necessary to be careful in consuming it, especially for children. Measurement of iodine levels in salt is carried out by mixing starch in salt or by using iodine test kit liquid. This iodine levels are measured in salt and divided into three categories (7-15 ppm, 20-27, and >30). The TCS3200 sensor is able to detect samples with two samples that do not contain iodine, and the others having different iodine levels. The iodine level test tool in salt was successful in measuring salt samples and grouping them into three categories. Some samples have different values for repetitive data as the colour sensor used is influenced by measuring distance with the colour of the object to be analysed. From the experiment , it was found that iodine content in salt was at the level of 7-27 ppm, while others had values much above 30 ppm. This tool can be developed using different sensors to measure the substances contained in salt.

Gahan B G et al. [23] performed the project "A Portable Colour Sensor Based Urine Analysis System to Detect Chronic Kidney Disease". The disease, which is a gradual loss of kidney function over 5 stages , is completely reversible if detected in the initial first two stages. A portable and reliable system consisting of light sensor TCS3200 and a urine strip has been developed to detect CKD in the initial two stages. The biomarker considered is albumin that is detected through the color change in the urine strip. With the development of this device , risks of diabetes, hypertension and cardiovascular disease has been considerably reduced.

P Rajkumar et al. [24] performed the project "Development of a farmer-friendly portable colour sorter cum grader for tomatoes". Ripened Tomato (Solanum Lycopersicon) which is a major horticulture crop grown worldwide is an excellent source of antioxidants. But, their transportation to long distances is a challenging task. However, the unripe tomatoes are opted for long-distance transportation due to their extended shelf-life. A sensor , with an efficient colour sorting program was developed using integrated circuits with a divergent rolling grader. This grader works on the principle of energetic reflection by measuring the intensity of light and it consists of inlet hopper, grader, outlet section, collecting trays , feed hopper, chain conveyor, belt conveyor, three colour sensor (TCS3200), collecting ducts etc,. The machine was operated by a single-phase 2 hp motor and it's performance was analysed by overall grading efficiency, skin damage measuring capacity, and sorting efficiency. During evaluation, the maximum sorting efficiency and overall grading efficiency obtained respectively were 94.5% and 94.1, 94.1, and 94.6% for ripe and unripe fruits, respectively. Colour sorting and size grading is absolutely essential at the field level to overcome human drudgery and to enhance the market value. The developed portable colour sensor cum grader can be used by the farmers/traders to increase their profits in the market. The capacity of this equipment is estimated to be approximately 40 kg/hr . While , Cost of operation of this equipment is estimated to be about Rs. 3/kg of tomatoes.

PROBLEM STATEMENTS

- We will try to develop the object sorting system using Arduino Uno as the brain of the system instead of using Arduino nano as the microcontroller for the system in order to increase the dimensionality of the system.
- We will try to interface the Arduino uno with LCD screen.
- We will try to interface the motor driver module with Arduino Uno to sort the objects in a desired manner.

REQUIREMENTS

A.HARDWARE:

1. Arduino Uno
2. TCS3200 colour sensor
3. 16×2 LCD
4. Motor driver module
5. Breadboard
6. Jumper wires
7. Arduino uno USB cable

B.SOFTWARE:

1. ARDUINO IDE

METHODOLOGY

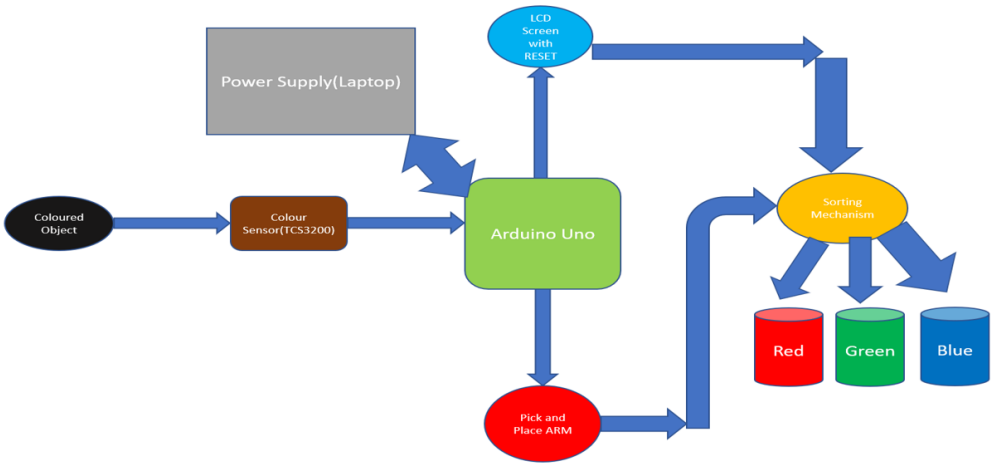


Fig. 1 RGB COLOR DETECTION USING TCS3200 BLOCK DIAGRAM

- Figure 1 shows a colour sorting system created using a variety of methods and sensors. The colour detection stage in this system is required to determine the RGB values of the objects that we will utilise in the colour sorting machine. The TCS3200 colour sensor is utilised in this project to determine an object's colour with the aid of photodiode arrays.
- The coloured object is to be placed in front of the colour Sensor which is to be integrated to the Arduino that is externally connected to the power supply (Laptop). Through the help of Programming, we are going to sort the objects based on their colours into Red, Green, Blue, Yellow etc. At last, we have incorporated an LCD screen, which is going to show us the number of objects of each colour. A Reset Button has also been incorporated to the LCD screen which resets all the values shown in the LCD screen to its initial value i.e., 0.

ALGORITHM OF ARDUINO CODE

1. Start the process.
2. Include the library to control the LCD using “#include <LiquidCrystal.h>” command.
3. Include the library to control the servo motor using #include <Servo.h>” command.
4. Create an object for the servo motor using “Servo servo1”
5. Define no. of samples to be 100u and store it in “NO_SAMPLES”.
6. Define the threshold value to be 15u and store it in “THRESHOLD”.
7. Now define the colour thresholds; Define the threshold value of red color in ideal condition to be 190u and store it in “IDLE_RED_THRESHOLD ”.
8. Define the threshold value of green color in ideal condition to be 160u and store it in “IDLE_GREEN_THRESHOLD ”.
9. Define the threshold value of blue color in ideal condition to be 75u and store it in “IDLE_BLUE_THRESHOLD ”.
10. Define the value of R in presence of red colour to be 315u and store it in “RED_RED_THRESHOLD”.

11. Define the value of R in presence of green colour to be 575u and store it in "RED_GREEN_THRESHOLD".
12. Define the value of R in presence of blue colour to be 495u and store it in "RED_BLUE_THRESHOLD".
13. Define the value of G in presence of red colour to be 140u and store it in "GREEN_RED_THRESHOLD".
14. Define the value of G in presence of green colour to be 550u and store it in "GREEN_GREEN_THRESHOLD".
15. Define the value of G in presence of blue colour to be 520u and store it in "GREEN_BLUE_THRESHOLD".
16. Define the value of B in presence of red colour to be 20u and store it in "BLUE_RED_THRESHOLD".
17. Define the value of B in presence of green colour to be 500u and store it in "BLUE_GREEN_THRESHOLD".
18. Define the value of B in presence of blue colour to be 375u and store it in "BLUE_BLUE_THRESHOLD".
19. Define the sensor connections. Define S0 as 8 as it is connected to the D8 pin of the Arduino Uno; Define S1,S2,S3 and Sout as 9,10,11,and 12, respectively.
20. Define the pins for the LCD connection. Define RS,EN,D4,D5,D6, and D7 as 13,7,2,3,4, and 5, respectively.
21. Use "LiquidCrystal lcd(RS, EN, D4, D5, D6, D7)" to setup the LCD pins.
22. Define a variable "sumOfSamples" to store the sum of all the samples.
23. Define a variable "redData" to store the value of R.
24. Define a variable "greenData" to store the value of G.
25. Define a variable "blueData" to store the value of B.
26. Define a variable "r_count" to count the no. of red objects.
27. Define a variable "g_count" to count the no. of green objects.
28. Define a variable "b_count" to count the no. of blue objects.
29. Define flag variables "idle_flag", "red_flag", "green_flag", and "blue_flag" for unknown, red, green, blue coloured objects.
30. Define "servoPin" as 6 as it is connected to D6 pin of Arduino Uno.
31. Declare a function setup with return type void.
32. Attach the servo motor with the servo pin using "servo1.attach(servoPin)" command.
33. Use "pinMode" command to set S0, S1, S2, S3 as output pins.
34. Use "pinMode" command to set Sout pin as the input pin.
35. Give digital high pulse to S0 pin.
36. Give digital low pulse to S1 pin.
37. Start serial communication with 9600 baud rate.
38. Set the number of columns as 16 and no. of rows as 2 for the LCD.
39. Move LCD cursor to (0,0).
40. End the setup function.
41. Declare a function "loop" with return type void.
42. Declare a variable i and store 0 in it.
43. Apply red filter by giving digital low pulse to S2 and S3 pins.
44. Give a delay of 1ms.
45. Declare a variable to store the sum of the samples.

46. Run a for loop from 0 to no. of samples. In each iteration, calculate the pulse width for Sout pin using “pulseIn” command and add to “sumOfSamples”. In this way, “sumOfSamples” gets incremented in each iteration.
47. Calculate the value of R by dividing the final value of “sumOfSamples” by “NO_SAMPLES”. Serially print the value of R.
48. Give a delay of 100 ms.
49. Now, apply green filter by giving digital high pulse to S2 and S3 pins.
50. Repeat steps 44,45,46.
51. Calculate the value of G by dividing the final value of “sumOfSamples” by “NO_SAMPLES”. Serially print the value of G.
52. Give a delay of 100 ms.
53. Now, apply blue filter by giving digital low pulse to S2 pin and digital high pulse to S3 pin.
54. Repeat steps 44,45,46.
55. Calculate the value of B by dividing the final value of “sumOfSamples” by “NO_SAMPLES”. Serially print the value of B.
56. Give a delay of 100 ms.
57. Check if the status of isidle() function is true or not. If it is true, turn off all LEDs. Clear idle_flag, and set red_flag, green_flag and blue_flag to 1.
58. Check if the status of isRed() function is true or not. If true, turn on red LED.
59. Check status of red_flag. If true, set idle_flag, green_flag, and blue_flag to 1 and clear red_flag.
60. Increment r_count by 1, and serially print it.
61. Clear the display screen of LCD.
62. Move cursor to (0,0).
63. Print “RED” in the LCD screen.
64. Move cursor to (0,1).
65. Print the r_count, g_count and b_count values in the LCD screen.
66. Rotate the servo motor by 60 degree.
67. Check if the status of isGreen() function is true or not. If true, turn on green LED.
68. Check status of green_flag. If true, set idle_flag, red_flag, and blue_flag to 1 and clear green_flag.
69. Increment g_count by 1, and serially print it.
70. Clear the display screen of LCD.
71. Move cursor to (0,0).
72. Print “GREEN” in the LCD screen.
73. Move cursor to (0,1).
74. Print the r_count, g_count and b_count values in the LCD screen.
75. Rotate the servo motor by 120 degree.
76. Check if the status of isBlue() function is true or not. If true, turn on blue LED.
77. Check status of blue_flag. If true, set idle_flag, green_flag, and red_flag to 1 and clear blue_flag.
78. Increment b_count by 1, and serially print it.
79. Clear the display screen of LCD.
80. Move cursor to (0,0).
81. Print “BLUE” in the LCD screen.
82. Move cursor to (0,1).
83. Print the r_count, g_count and b_count values in the LCD screen.
84. Rotate the servo motor by 180 degree.

85. Now, check whether status of isRed(), isGreen(), and isBlue() functions are all false or not. If all are false, set idle_flag, green_flag, blue_flag and red_flag to 1.
86. Clear the display screen of LCD.
87. Move cursor to (0,0).
88. Print “Unknown Color” in the LCD screen.
89. Move cursor to (0,1).
90. Print the r_count, g_count and b_count values in the LCD screen.
91. Rotate the servo motor by 0 degree.
92. Give a delay of 2s and keep running the loop function indefinitely.
93. Declare a function isIdle(void) with return type Boolean.
94. Declare a Boolean variable “status” and initialize it with false.
95. If “redData” lies between IDLE_RED_THRESHOLD-THRESHOLD and IDLE_RED_THRESHOLD+THRESHOLD , “greenData” lies between IDLE_GREEN_THRESHOLD-THRESHOLD and IDLE_GREEN_THRESHOLD+THRESHOLD, and “blueData” lies between IDLE_BLUE_THRESHOLD-THRESHOLD and IDLE_BLUE_THRESHOLD+THRESHOLD, make status equal to true and return the value of status variable to the loop function.
96. Close the isIdle() function.
97. Declare a function isRed(void) with return type Boolean.
98. Declare a Boolean variable “status” and initialize it with false.
99. If “redData” lies between RED_RED_THRESHOLD-THRESHOLD and RED_RED_THRESHOLD+THRESHOLD , “greenData” lies between RED_GREEN_THRESHOLD-THRESHOLD and RED_GREEN_THRESHOLD+THRESHOLD, and “blueData” lies between RED_BLUE_THRESHOLD-THRESHOLD and RED_BLUE_THRESHOLD+THRESHOLD, make status equal to true and return the value of status variable to the loop function.
100. Close the isRed() function.
101. Declare a function isGreen(void) with return type Boolean.
102. Declare a Boolean variable “status” and initialize it with false.
103. If “redData” lies between GREEN_RED_THRESHOLD-THRESHOLD and GREEN_RED_THRESHOLD+THRESHOLD , “greenData” lies between GREEN_GREEN_THRESHOLD-THRESHOLD and GREEN_GREEN_THRESHOLD+THRESHOLD, and “blueData” lies between GREEN_BLUE_THRESHOLD-THRESHOLD and GREEN_BLUE_THRESHOLD+THRESHOLD, make status equal to true and return the value of status variable to the loop function.
104. Close the isGreen() function.
105. Declare a function isBlue(void) with return type Boolean.
106. Declare a Boolean variable “status” and initialize it with false.
107. If “redData” lies between BLUE_RED_THRESHOLD-THRESHOLD and BLUE_RED_THRESHOLD+THRESHOLD , “greenData” lies between BLUE_GREEN_THRESHOLD-THRESHOLD and BLUE_GREEN_THRESHOLD+THRESHOLD, and “blueData” lies between BLUE_BLUE_THRESHOLD-THRESHOLD and BLUE_BLUE_THRESHOLD+THRESHOLD, make status equal to true and return the value of status variable to the loop function.
108. Close the isBlue() function.
109. Stop the process.

LINK OF ARDUINO CODE

https://docs.google.com/document/d/19FrFzDdEf0NMr6kwyu_r7WljWQy34K4ELVak7r3sick/edit?usp=sharing

RESULTS AND DISCUSSIONS

A microcontroller and the TCS3200 colour sensor are used to detect colour changes based on their wavelength for the purpose of categorising colours. The sensor uses four distinct photodiode arrays with 8x8 arrays to convert light into current. The hardware arrangement is shown in figure 2.

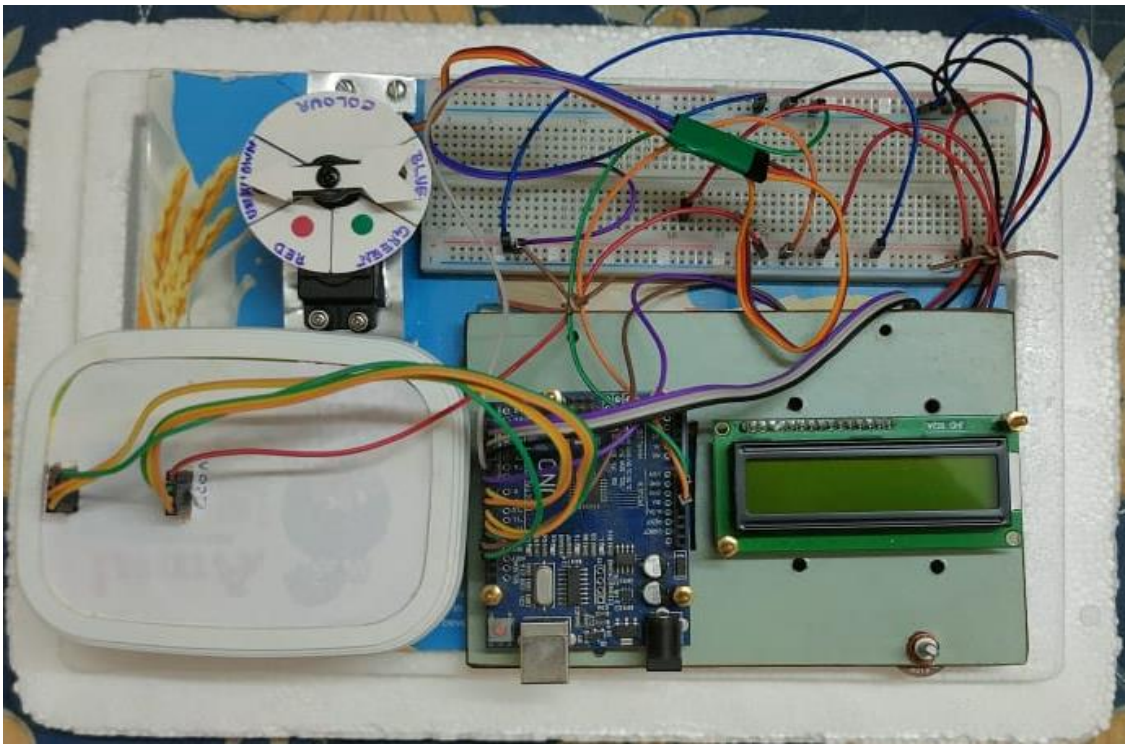
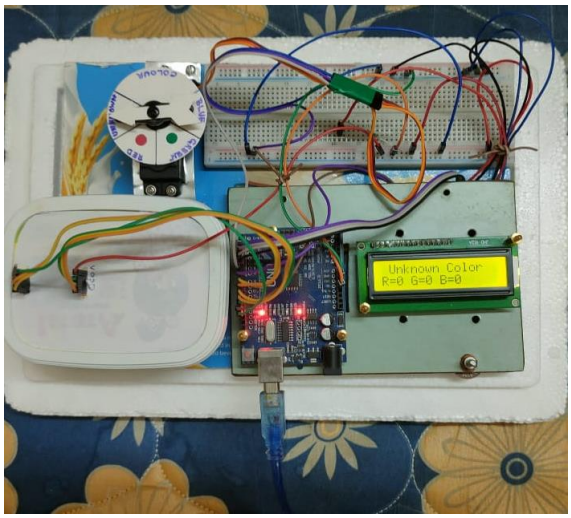


Fig. 2 Hardware Setup

The system is connected to the power supply and started. This is shown in figure 3. Initially the sensor detects no colour so led screen shows unknown color. Correspondingly the values are updated in serial monitor.



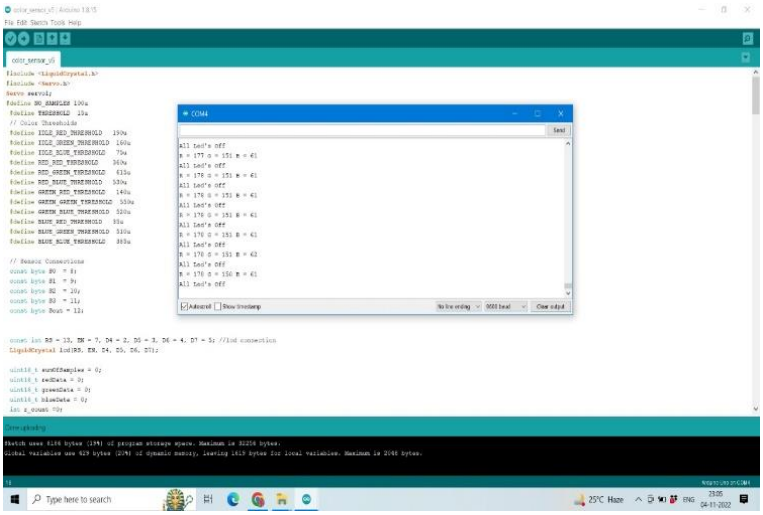


Fig. 3 Start-up

A. Red Object

When a red card is placed inside the chamber the pointer turns towards red and the led screen appends the value of red by one. In figure 4 this is demonstrated. Correspondingly the values are updated in serial monitor.

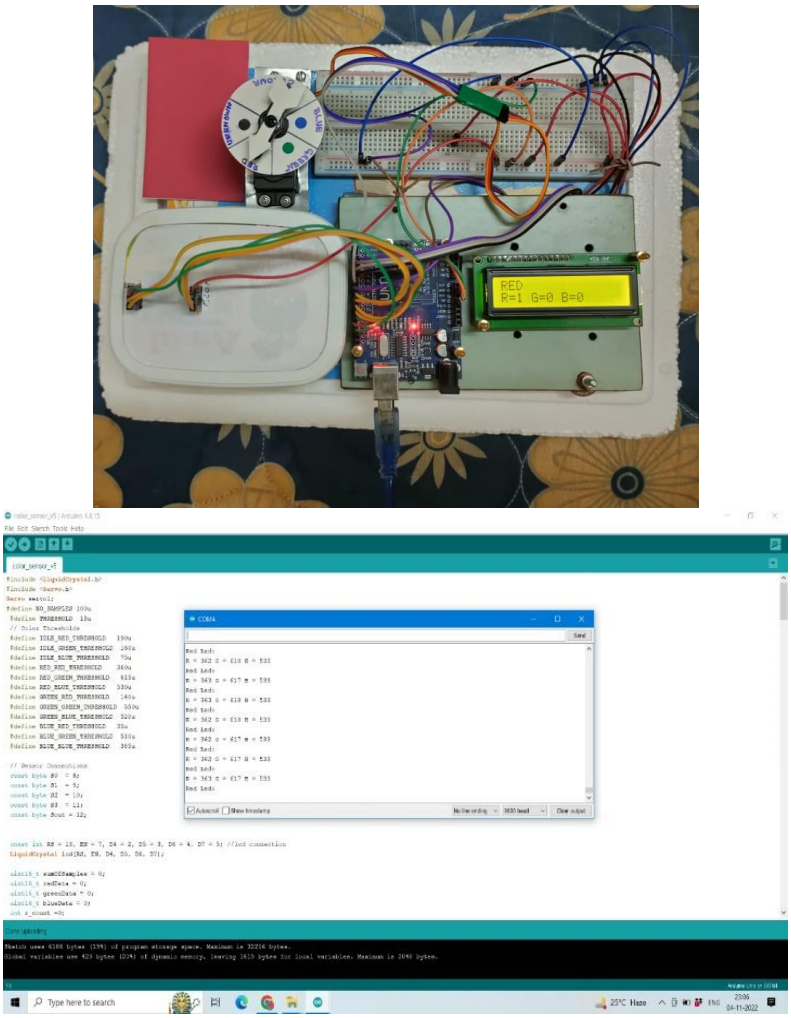


Fig. 4 Detecting Red Object

B. Green Object

When a green card is placed inside the chamber the pointer turns towards green and the led screen appends the value of green by one. In figure 5 this is demonstrated. Correspondingly the values are updated in serial monitor.

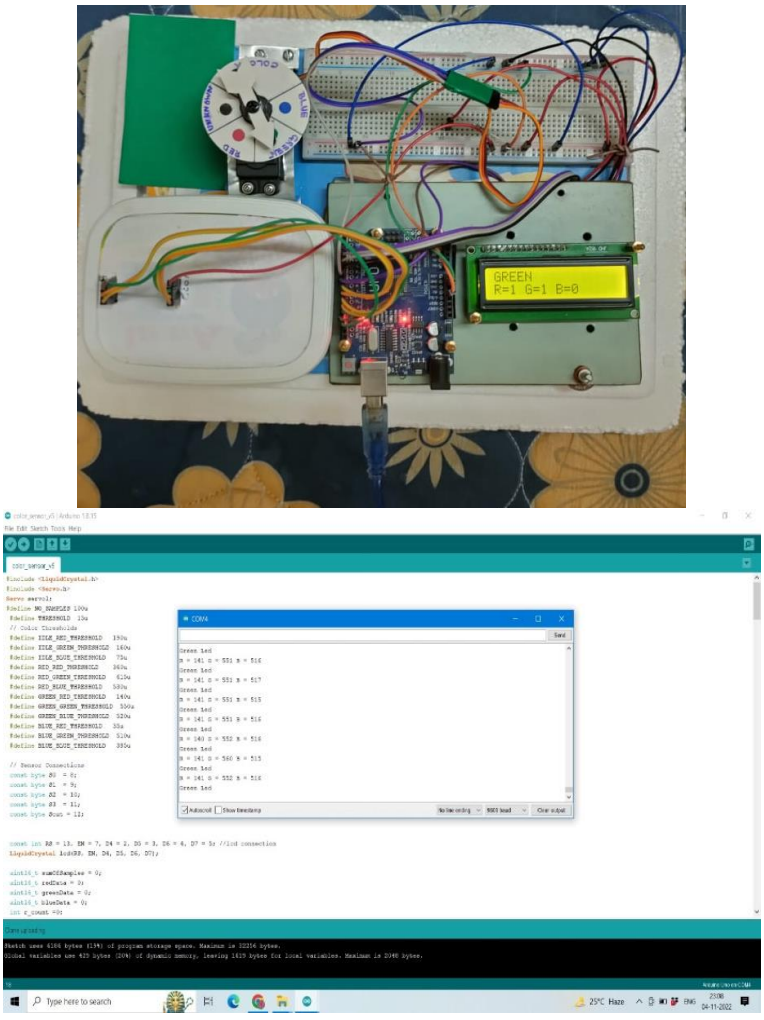


Fig. 5 Detecting Green Object

C. Blue Object

When a blue card is placed inside the chamber the pointer turns towards blue and the led screen appends the value of blue by one. In figure 6 this is demonstrated. Correspondingly the values are updated in serial monitor.

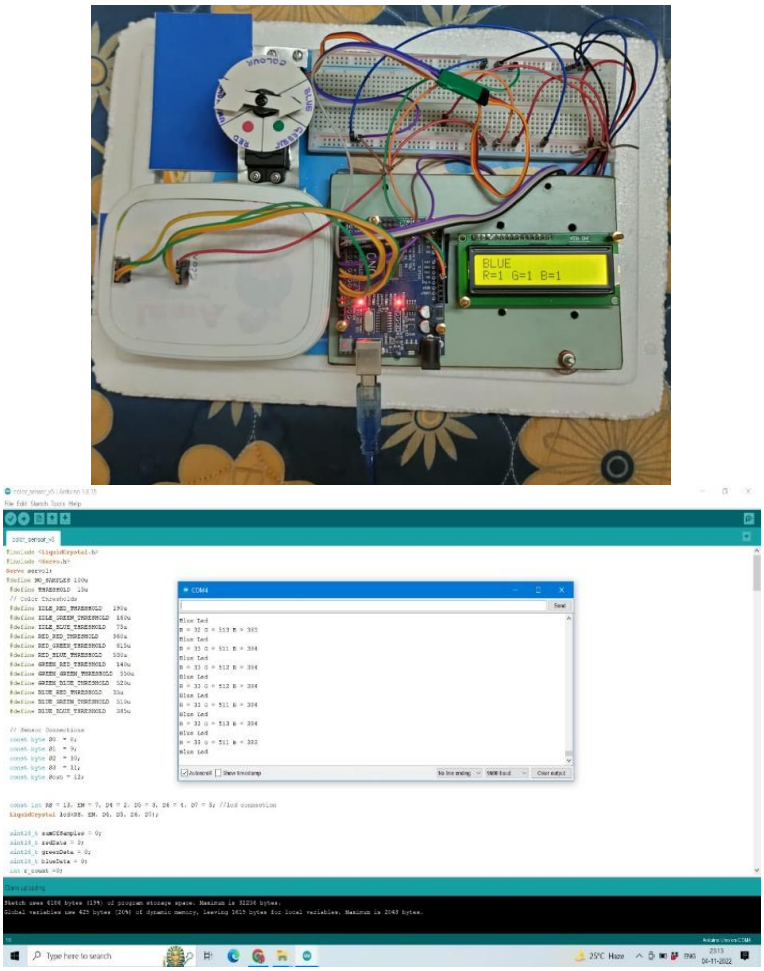


Fig. 6 Detecting Blue Object

The proposed design uses arduino uno opposed to nano which gives us more dimentioanlity. Arduino Uno comprises of 14 digital input/output pins, which means it can be cinfigured with other sensors to acquire more data and produce better results. The processing is also faster. The overall cost of the system is cheap and can be implemented easily.

This system design is also modular. Some tweaks can be made to it and can be implemented in various ways. Like sorting fruits based on their ripeness like in[4] or a non-invasive method of diagnosing health parameters using urinalysis like in [5] and also similar work in [23]. A robotic arm can also be added to increase functionality like in [6] and [19].

CONCLUSION

The following conclusions can be drawn from the design, execution, and testing outcomes. The prototype's grouping or sorting procedure is reliable and not greatly impacted by outside circumstances. The counted data is also accurate. This technique is ideal for sectors of the economy where object sorting is frequently necessary. The proposed design's adoption will increase productivity, lower manufacturing costs, and speed up object packing with less labor-intensive labour. Sorting is managed by Arduino using colour identification. Based on the frequency analysis of the sensor's output, colour is identified. The proposed system is simpler to adopt in small scale industries, reducing manual power, thanks to cost-effective system implementation and size scalability.

APPLICATIONS

Some of the applications of object sorting system are as follows:

1. Object sorting system is required in packaging industries.
2. It is also required in logistics industry.
3. It can also be used for sorting fruits based on their colour and shape.
4. It can be used to identify the maturity stages of fruits.
5. It can be used to develop a robotic arm to sort objects based on their colour and shape.

FUTURE SCOPE

The object sorting system can be improved in many areas. The sorting system can be made to operate faster by using a more powerful microcontroller than Arduino Uno. In this way, the time response of the system and efficiency of the system performance can be improved. Complex image processing techniques can be applied to identify objects with multiple colours and multiple shapes.

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