International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

Proposed Work On Object Sorting Using Color Sensing

Mukul Lal[1], Zulfikar Ali[2], Mrinal Pandey[3], Nitesh Prajapati[4], Gaurav Gupta[5], Kushan Krishna[6]

[1]*Mukul Lal, UG Student, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*
[2]*Zulfikar Ali, Assistant Professor, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*
[3]*Mrinal Pandey, UG Student, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*
[4]*Nitesh Prajapati, UG Student, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*
[5]*Gaurav Gupta, UG Student, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*
[6]*Kushan Krishna, UG Student, CS Department, BBDNITM, Lucknow -227105, Uttar Pradesh, India*

Abstract - *Sorting products is one of the major processes in many industries. Industries dealing with manufacturing, assembling, packaging etc. need economically and technically feasible solutions to sorting their products/raw materials. Sorting can be done on the basis of the products shape, size, color or any other physical properties. These sorting processes must be fast, efficient and cheap so as to be deployable in the industries. The objective of this paper is to provide the blueprint of a working solution of an automated product sorting machine which sorts the product based on its color. It aims to minimize the factors such as human error, fatigue and less precision. The components used are micro servo motors, Arduino UNO, Color sensor [7], PCB and a basic structure which comprises of a moving shaft and a rotating platform that holds the products in place and keeps the product moving in a uniform manner. It used IoT technology which helps in operating the machine wirelessly.*

Key Words: **Arduino UNO, Internet of Things, Color sensor, Servo motor, C++ Programming, Stepper motor, LED, RGB etc.**

1.INTRODUCTION

IoT (Internet of Things)

In today's internet the overwhelming majority of IP addresses are held by computers and computer-like devices, whose function is to form calculations, and display them to users as information terminals. As we're only within the beginning stages of IoT [9]: the amount of IoT devices reached 8.4 billion in 2017 and is predicted to succeed in 30 billion devices by 2020. We're already using and benefitting from IoT. We turn off electric appliances remotely if we forget to. We leave for work and preheat our ovens and turn on AC our way home from work, all while tracking our fitness on our smart watch and hailing a ride with uber. But businesses and industries even have much to realize now and within the near future. The IoT can enable better safety, efficiency and decision for businesses as the data is collected and analyzed. It can enable predictive services like regular maintenance, better medical aid, improve customer service, and offer benefits we haven't even imagined yet.

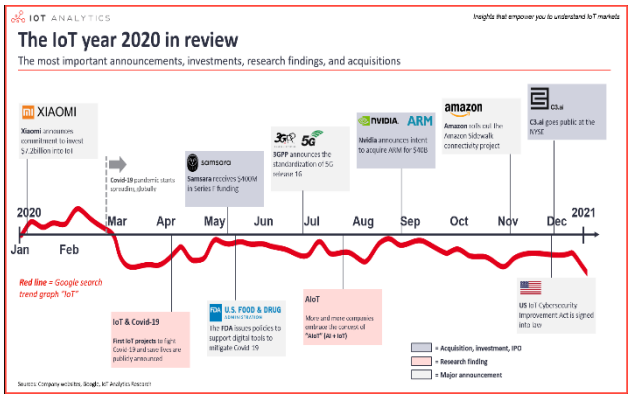

Fig -1: IoT analytics over the year 2020 (https://iot-analytics.com/iot-2020-in-review/)

1.1 Arduino Uno

We use Arduino Uno [10] which works as a microcontroller board. Arduino Uno was developed by Arduino.cc. It is open-source and based on the microprocessor chip ATmega328P [11]. The board has analog and digital input and output pins. These pins are often interfaced with other expansion boards and circuits. The board contains 14 digital input/output pins and 6 analog pins. Out of those 14 digital pins, 6 are capable of PWM output. The board is programmed with the assistance of Arduino IDE. We can use a USB cable or a 9 Volt battery to deliver power the board. It operates between 7 to 20 volts. we will derive its similarity to Arduino Nano and Leonardo. Arduino Uno is the first board that came under USB powered Arduino boards lineup; hence the name "Uno" meaning "one" in Italian. The chip used on the board is preprogrammed out of the box with a bootloader. This helps us add new code and not having to worry about a hardware programmer external to the system. Arduino Uno uses STK500

protocol (original). However, it doesn't use FTDI USB-to-serial driver chip. It uses ATmega16U2.

1.2 Color Sensing

A shading detecting gadget comprises of an extreme focus white LED (light-emitting diode) that extends a harmonized light onto the objective. The white light contains a combination of three essential tones having various frequencies as referenced above (RGB). These tones can consolidate with each other to frame various shades of tones. At the point when the white light falls on a specific surface, in view of the properties of the outside of the material, a portion of the frequencies of light are retained and some are reflected back. People can identify the shade of the material when these considered frequencies fall that material.

Shading acknowledgment frameworks dependent on white LED are liked for assessment over those dependent on RGB LED. Aside from LEDs, there are different diverse light sources like fiber optics, lasers, and incandescent lights that can be utilized in the plan of shading detecting gadgets [3].

S0	*S1*	*Output Frequency Scaling*	*S2*	*S3*	*Photodiode Type*
L	L	Power down	L	L	Red
L	H	2%	L	H	Blue
H	L	20%	H	L	Clear (no filter)
H	H	100%	H	H	Green

Fig -2: TCS 230 frequency scaling and photodiode type (https://howtomechatronics.com/tutorials/arduino/arduino-color-sensing-tutorial-tcs230-tcs3200-color-sensor/)

2. COMPONENTS USED

The components used are listed below:

a) Stepper motor
b) MG995 Servo Motor

Fig -3: MG995 Servo Motor (https://www.electronicscomp.com/mg995-metal-gear-servo-motor-180-degree-rotation)

c) Metal shaft
d) Foam board base
e) Arduino UNO

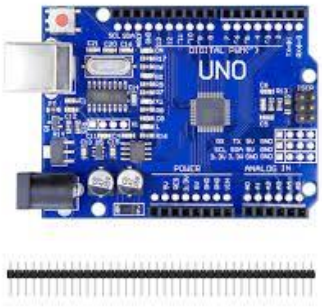

Fig -4: Arduino UNO (https://kuongshun.com/products/uno-r3-board-ch340-for-arduino)

f) Motor driver
g) Plexi glass
h) Color sensor (TCS230)

Fig -5: TCS230 Color sensor (https://ardubotics.eu/en/sensors/1788-gy-31-tcs230-tcs3200-color-sensor.html)

3. PROPOSED WORK

The products/objects are given as input to the machine. The objects can be fed in any random order. For the given work, objects of similar shape will give better accuracy of sorting results. The object falls through a transparent pipe which guides it to the circular disc having slots which hold the object in place. The disc rotates with the help of a servo motor and the objects eventually come under the proximity of the color sensor.

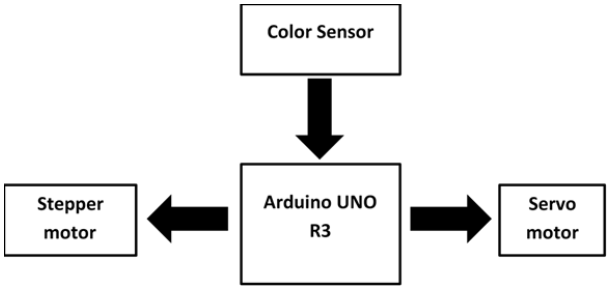

Fig -6: Block diagram of the system

The color sensor detects the color of the objects and feeds it to the mechanical shaft. We don't make use of robotic arm [6][1], rather we use a shaft attached to a servo motor. The micro servo motor controls the shaft which in turn guides the objects into their respective glass containers. The code that enables the color sensor to differentiate between the objects based on their color and to move the shaft is written into the Arduino Uno with the help of C++ programming language [4].

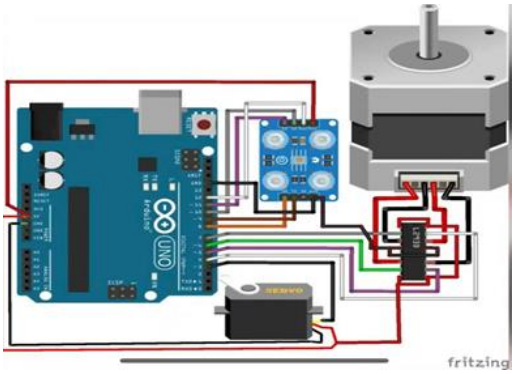

Fig -7: Circuit diagram of the system
(Fig-7- https://fritzing.org)

4. DESIGN AND CONSTRUCTION

The overall Structure consists of different parts such as a power supply, Arduino UNO, servo motor, stepper motor, metal shaft, foam board base, glass tumbler to store the sorted different colored disks, colored disks and conveyor shifting structure [5].

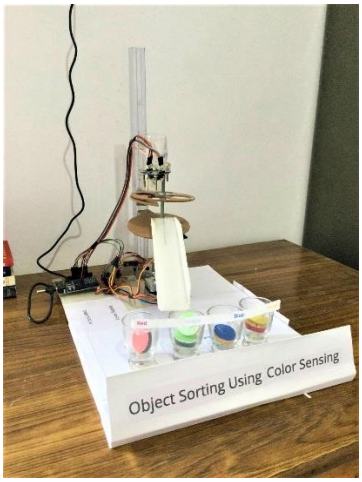

Fig -8: Front view

The base of the overall design is made with foam board. On the foam board the components like Arduino UNO and stepper motor are attached. One vertical square transparent tube is used to support the entire working structure. To this tube is attached another circular fiber tube to store the colored disks, one by one the disks drop to a circular wooden disk with some circular holes made in it to get their color sensed by the color sensor. This circular disk is connected to a stepper motor via a metal shaft [2] which rotates it so that another colored disk can fall down in place where the first disk was and get ready to be sensed.

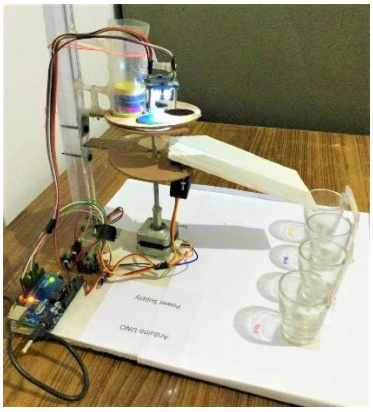

Fig -9: Side view

The color Sensor is attached to the tube in which the disks are stored. Below the wooden circular disk is another circular disk with exactly the same dimensions but with no holes. This disk is made to move a conveyor type structure made with fiber to put the colored disks in different glass tumbler according to the color of the disks. This fiber structure is connected to a servo motor which helps it to move around in order to point to the different tumblers so that the disks can fall in the desired place. Different wiring connections can also be seen from the Arduino UNO to the servo and stepper motors and to the color sensor. To the Arduino UNO is connected a power supply Unit to power it up.

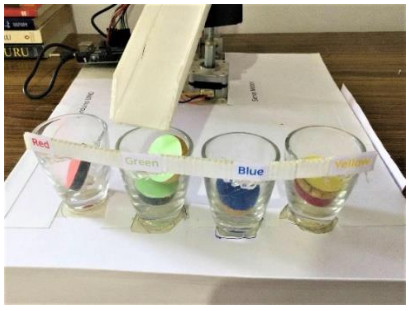

Fig -10: Containers for every color. Namely; red, green, blue and yellow (from left to right).

5. RESULTS

The color sensor detected the objects' color accurately. The movement of the shaft was precise although there was some delay in the movement. The sensor detected the four colors quite well, namely; blue, green, red and yellow. The objects were sorted based on their color correctly and dropped into to their respective containers.

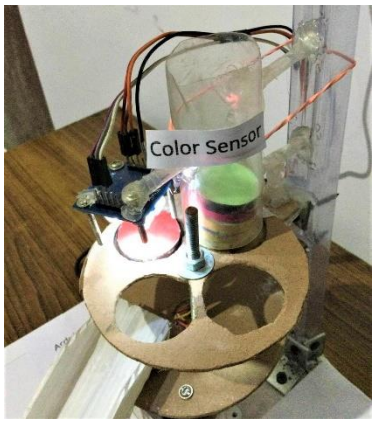

Fig-11: Color sensor sensing red object

Fig – 12: Red object placed in its container.

Fig – 13: Color sensor sensing blue object

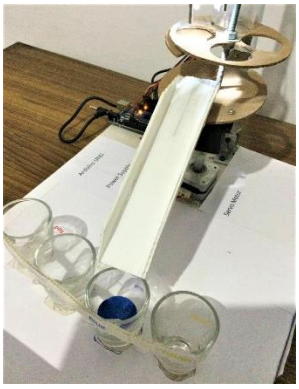

Fig – 14: Blue object placed in its container

Similarly, other objects are sorted and placed in their respective containers.

6. FUTURE SCOPE

The proposed work provides a prototype for a sorting machine that can be used in various industries such as in farm produce storage industries [8], crayon and pencil production, textile industry etc.

This work can be scaled to work on the basis of shape, temperature, moisture, rigidity or any other physical property that can be detected using current or future technology. The implementation can make the use of conveyer belts instead of discs. This makes the deployment in large scale industries feasible.

7. LIMITATIONS AND CHALLENGES

a) Color detection in case of wide range of colors may not be that accurate or efficient.

b) The lighting of the environment can change the frequencies detected and hence cause the color sensor to misbehave. Hence a conducive environment, such as a dark room is better.

c) The structure would bend sometimes causing some friction between the disc and the holding plate.

d) The materials used in making the structure were relatively soft in nature. Use of aluminum can make the structure stronger while preserving its weight limit.

8. CONCLUSIONS

This suggested work is as an economic, efficient, quick and technically feasible prototype for object sorting using color sensing. Making use of Arduino Uno and color sensor it is able to detect and sort the objects correctly. It is a low cost [4] alternative and hence can be improved upon. Failures can occur if the sensors and the environment are not proper. Despite having some limitations, if properly modified and scaled, the prototype has the ability to be deployed in various industries.

REFERENCES

[1] Szabó and I. Lie, "Automated colored object sorting application for robotic arms," 2012 10th International Symposium on Electronics and Telecommunications, Timisoara, 2012, pp. 95-98, doi: 10.1109/ISETC.2012.6408119.

[2] Sumardi, L. Febriramadhan and A. Triwiyatno, "Design of color-based object sorting through arm manipulator with inverse kinematics method," 2016 3rd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE), Semarang, 2016, pp. 117-122, doi: 10.1109/ICITACEE.2016.7892422.

[3] Automated Object Sorting Based On Color Detection 2nd International conference on Science, Technology & Management (ICSTM-2017)

[4] Aashik Chandramohan, Krishna Murthy K.R., Sowmya G., Surya Prasad P.A., Vijay Krishna V. Peeyush K.P., "Cost Effective Object Recognition and Sorting Robot Using Embedded Image Processing Techniques", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-11,pp-29-32, April 2014.

[5] Dharmannagsari Vinay Kumar Reddy," Sorting Of Objects Based On Color By Pick And Place Robotic Arm And With Conveyor Belt Arrangement", International Journal of Mechanical Engineering and Robotics research India, vol 3, No. 1, January 2014.

[6] Vishnu R. Kale1, V. A. Kulkarni "Object Sorting System Using Robotic Arm" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering vol.2, Issue 7, PP.3400-3407 July 2013

[7] Vishnu r. Kale, V. A. Kulkarni, "Automation of object sorting system using pick & Place Robotic arm & image processing", Proceedings of 3rd IRAJ International Conference, 5th January 2014, Mumbai, India. ISBN: 978-93-82702-51-1.

[8] Vindhya Devalla, Dr. Rajesh Singh, Amit Kumar Mondal, Vivek Kaundal, "Design and Development of Object Recognition and Sorting Robot for Material Handling in Packaging and Logistic Industries", International Journal of Science and Advanced Technology (ISSN 2221-8386) Volume 2 No 9, pp 30-35,September 2012

[9] The Internet of Things (IoT): Applications, investments, and challenges for enterprises In Lee a, *, Kyoochun Lee b a School of Computer Sciences, Western Illinois University, Stipes Hall 442F, Macomb, IL 61455-1390, U.S.A. bOlin Corporation, Clayton, MO, U.S.A.

[10] The Working Principle Of An Arduino. Yusuf Abdullahi Badamasi Nigerian Turkish Nile University Abuja, Nigeria

[11] An In-depth and Black-Box Characterization of the Effects of Laser Pulses on ATmega328P Dilip S V Kumar1, Arthur Beckers2 , Josep Balasch2 , Benedikt Gierlichs2 , and Ingrid Verbauwhede2 1 SEAL, Department of Computer Science and Engineering, IIT Kharagpur, India 2 imec-COSIC, KU Leuven Kasteelpark Arenberg 10, B-3001 Leuven-Heverlee, Belgium