Kongu Engineering College

DEPARTMENT OF MECHATRONICS ENGINEERING

18MTP71 – DESIGN AND FABRICATION

PROJECT PHASE II

DESIGN AND FABRICATION OF WASTE FABRIC SEGREGATION SYSTEM

Project Members

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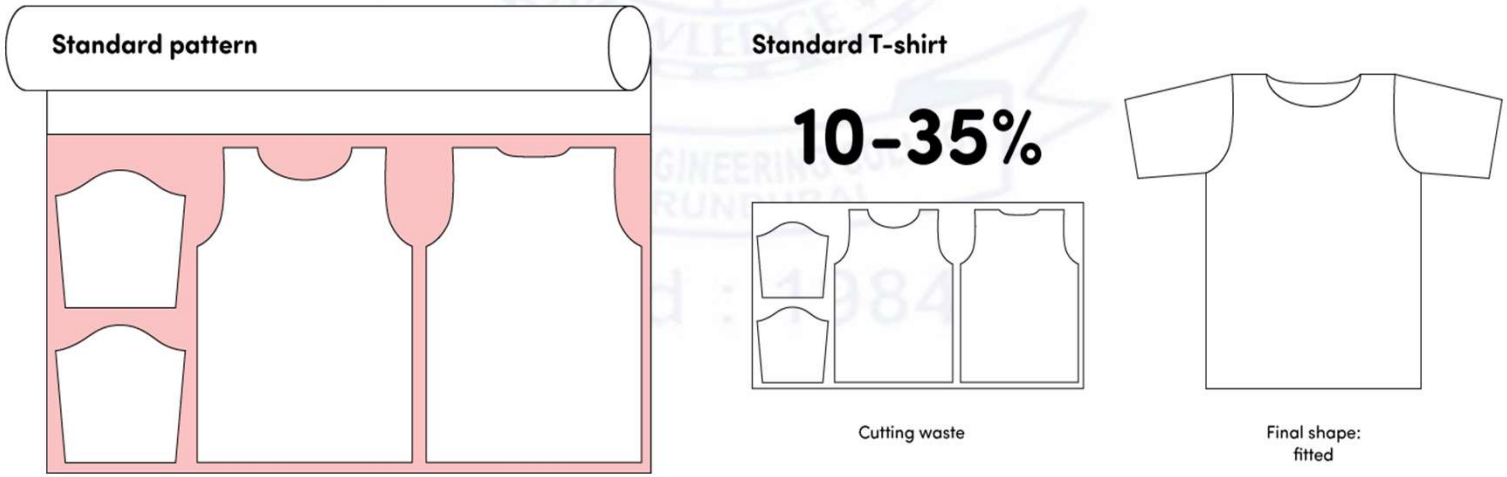
Estd : 1984

OVERVIEW

- Textile pre-production waste are generated more compared to waste generated post customer use.
- The existing system for recycling pre-production waste is tedious and slower.
- Our aim is to automate the complete process so that increase the rate of process and encourage recycling process more.

INTRODUCTION

- The segregation process is done by human labors by their bare hands.
- This makes the process more complicated and takes more time for segregation.
- This is one of the reasons, industries does not involve in the recycling process.
- If the process can be automated and human labors can be replaced, this process could be done in a wide range and the pile of waste fabrics ended up in landfills can be reduced to zero.



LITERATURE REVIEW

S.No	Author(s) & Year	Article Title & Journal Name	Inferences
1	Zhang, H., Liang, H., Ni, T., Huang, L. and Yang, J., 2021	Research on multi-object sorting system based on deep learning. Sensors, 21(18), p.6238	Inferred about various methods of algorithm used to sort the object
2	Habich, U., 2007	Sensor-based sorting systems in waste processing, International SymposiumMBT.	Inferred about sorting methods like NIR-sorting, inductive sorting,X-Ray sorting
3	Kulkarni, A.B., Jaisingpure, P.S. and Lenina, S.V.B.(2017)	Automated Object Sorting Based On Color Detection	Inferred about object sorting based on HSV (hue,saturation,value) of color with the help of image sensor and Raspberry Pi
4	Tomovska, E., Jordeva, S., Trajković, D. and Zafirova, K., 2014, November	Pre-consumer apparel waste mangement in Macedonia, In Book of proceedings 6 th International Conference of Textile	Inferred about the existing level of apparel waste cuttings management

SUMMARY OF THE LITERATURE REVIEW

From all the literatures, we have surveyed and we gained some knowledge about

- the existing system of the pre-production waste maintenance system available in various places around the world,
- methods used to recycle the waste,
- problem faced due to the waste,
- various solutions proposed for maintenance,
- other systems to recycle & segregate the waste produced post-customer usage
- and methods used to segregate the materials based on color or materials fiber.

PROBLEM DEFINITION

- In textile industries, discarded fabric waste are piled up and collected as a bundle for recycling process.
- It is then separated by people manually into individual bundles without any machinery.
- This segregation process is a tedious and time consuming work and our motive is to automate the segregation process easier and rapidly

OBJECTIVES

The main objective of the project is to design, construct and evaluate an effective system to separate the waste materials and segregate it rapidly based on color.

FEASIBILITY STUDY

- The system will reduce the number of labors involved in the traditional system and increase the rate of process, hence this will benefit economically.
- The project consist of simple and mostly familiar components with simple addition of programming for automation of process, ordinary mechanical setups and simple electrical circuits, there is no big complications involved in operations.
- The system is technically suitable and can be applied for industrial level of segregation system. Hence this system is feasible technically also.

PROPOSED METHODOLOGY

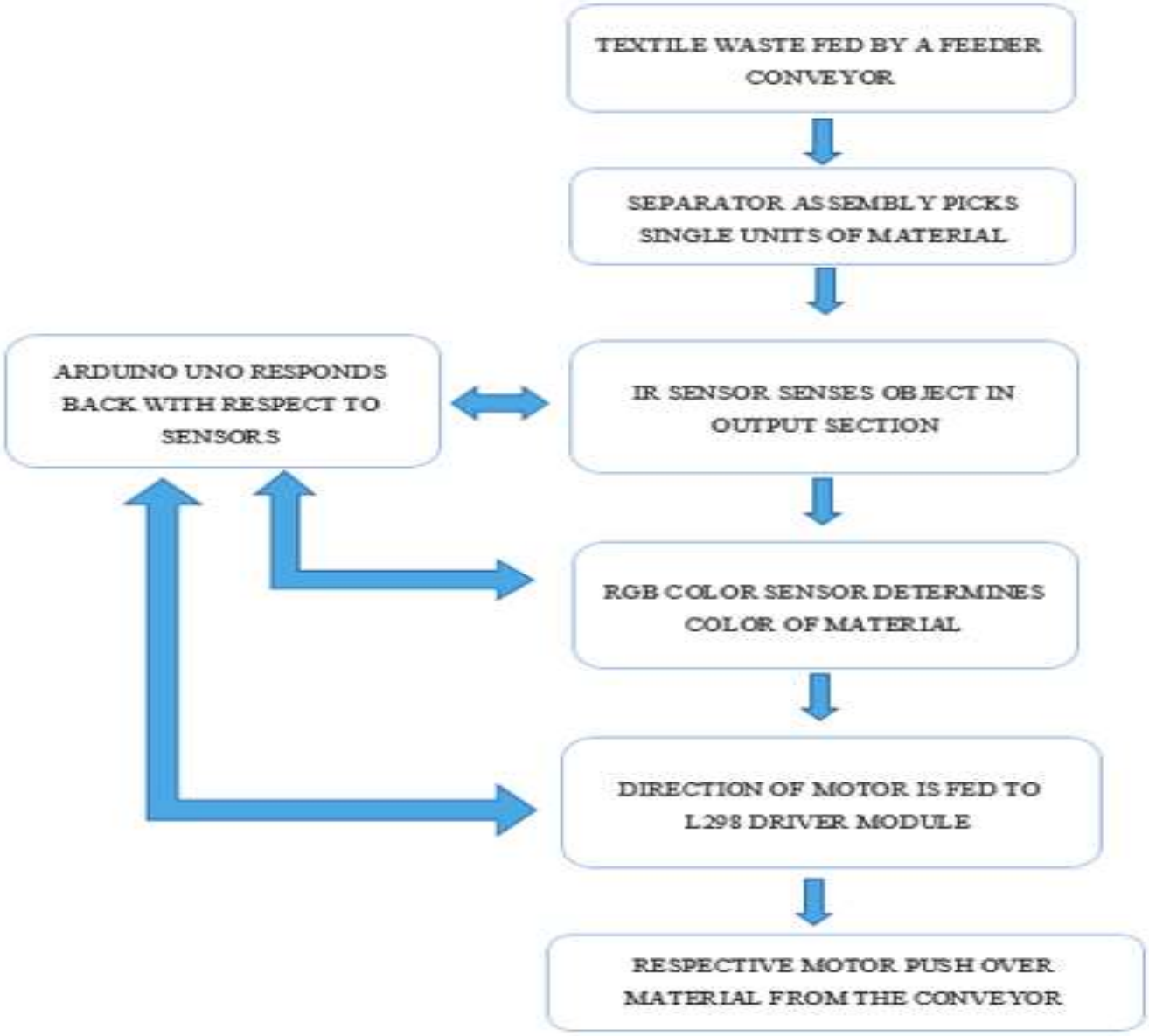
- Our proposed solution is a complete machine vision system to segregate the large units of materials to individual smaller units and then sorting them based on colors.

- This system can be divided into two sections, in first, the large amount of waste is fed in a conveyer is picked as small units by mechanical setup designed which is driven by an external motor.

- After that, the material reaches another section where an IR sensor is used to sense the object in the output conveyor, then an RGB color sensor to read the color value of the material passes through and electrical actuators to sort or in other terms to push over the material based on the color.

- The system can only sort particular colors and other unsorted materials can be recycled back to the system and the process can repeated again.

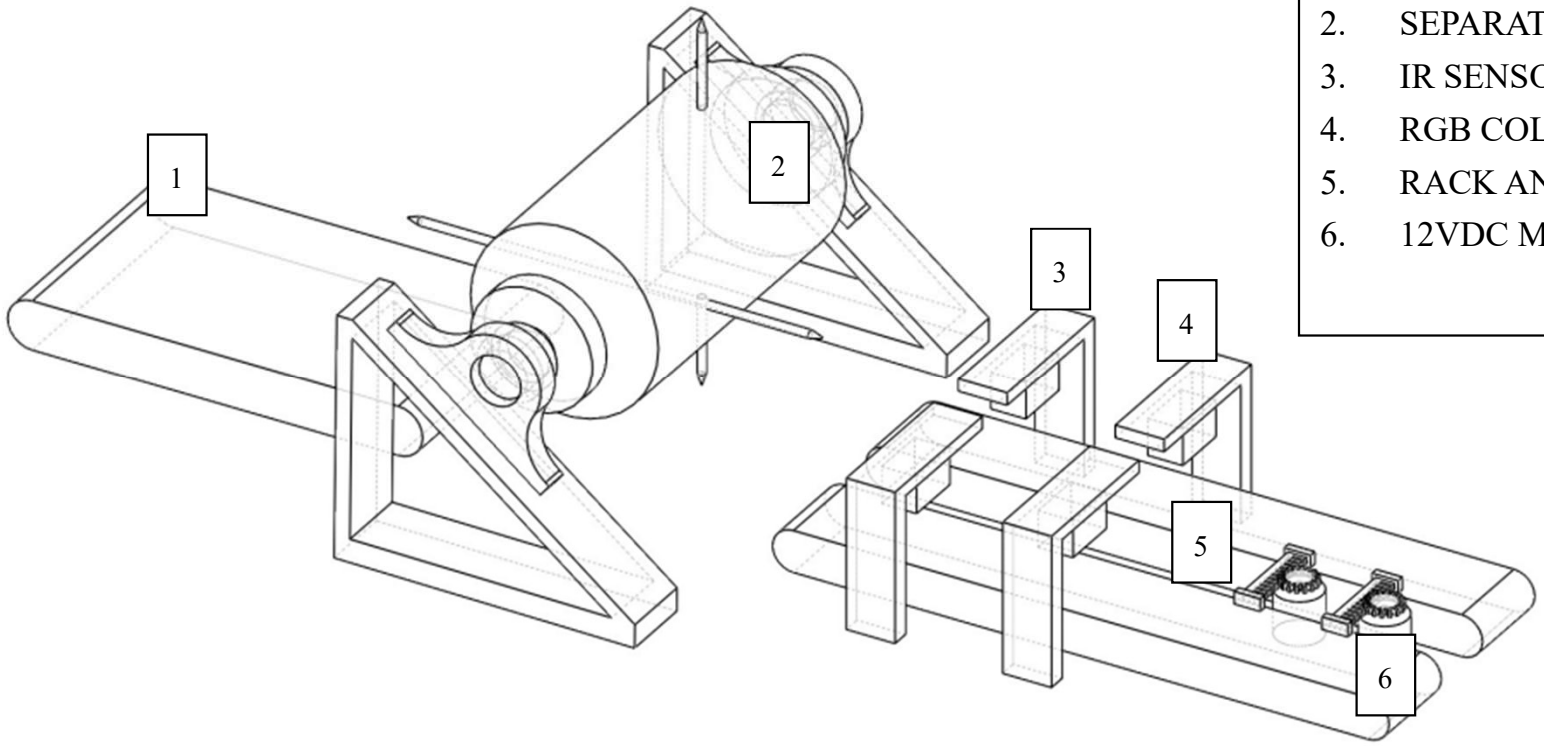
CONCEPTUAL MAPPING



EXPECTED OUTCOME

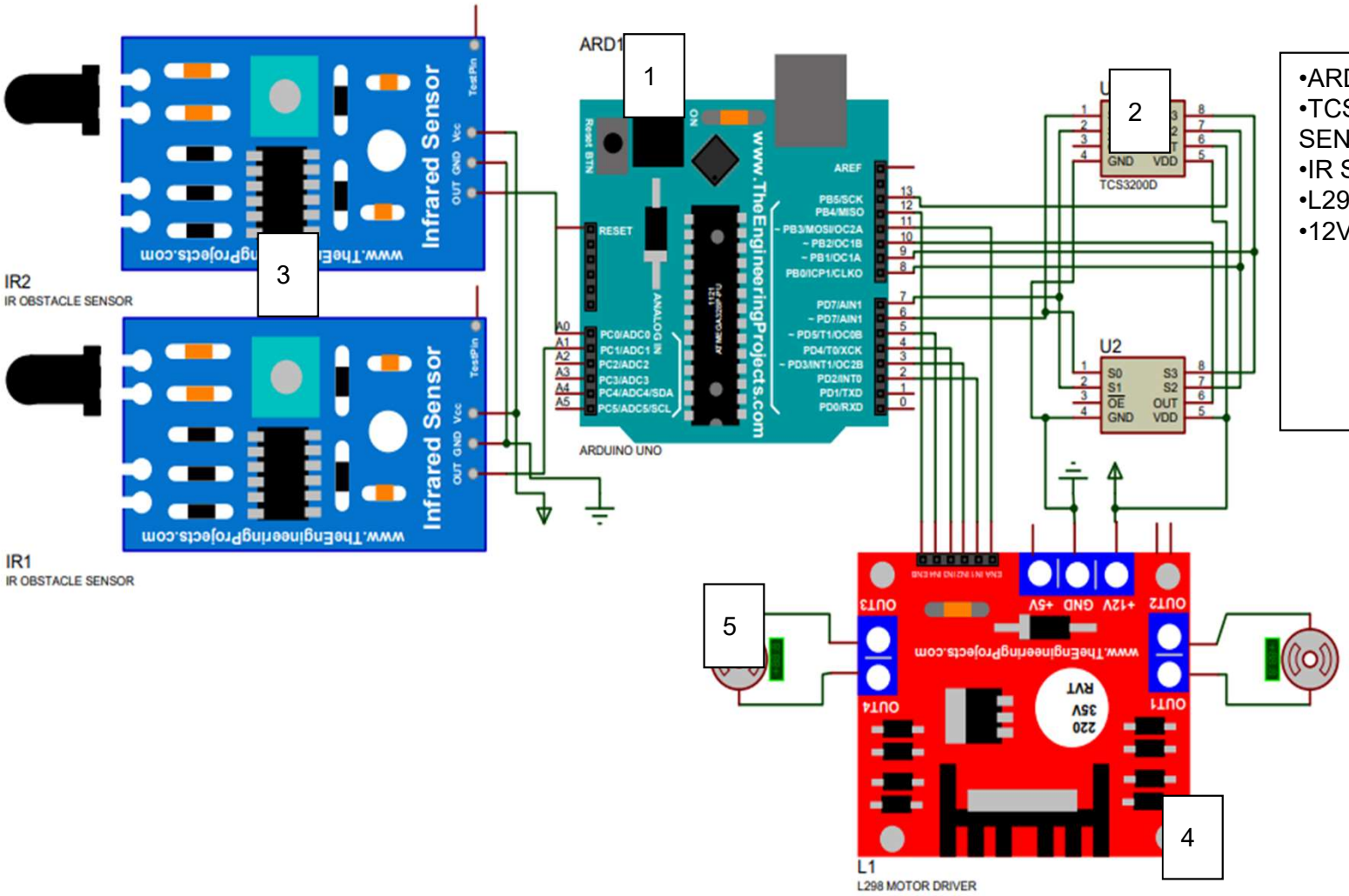
- To increase the rate of the segregation process.
- To remove all the complex parts of process and make it easier.
- To reduce human intervention in process
- To encourage recycling more than landfill dumping.

3D MODEL DESIGN



1. FEEDER
2. SEPARATOR
3. IR SENSOR
4. RGB COLOR SENSOR
5. RACK AND PINION
6. 12VDC MOTOR

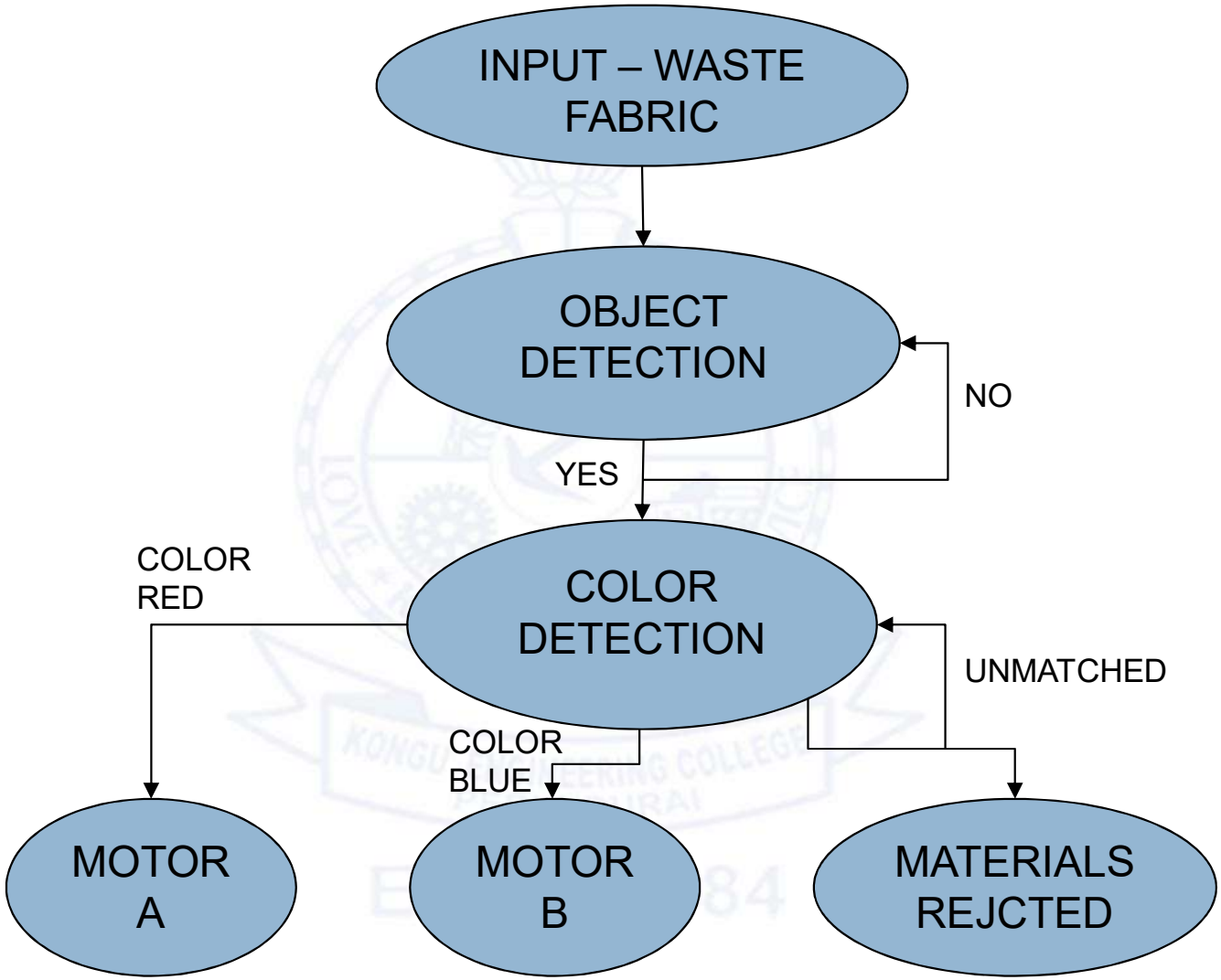
CIRCUIT DESIGN



- ARDUINO UNO
- TCS3200 COLOR SENSOR
- IR SENSOR
- L298N DRIVER
- 12V DC MOTOR

FABRICATION SETUP

PROGRAMMING ALGORITHM



PROGRAMMING ALGORITHM

```
int enA = 11;
int in1 = 2;
int in2 = 3;
int enB = 12;
int in3 = 4;
int in4 = 5;
#define S0 6
#define S1 7
#define S2 8
#define S3 9
#define sensorOut1 10
#define sensorOut2 13

// Stores frequency read by the photodiodes
int red1 = 0,red2 = 0;
int green1 = 0,green2 = 0;
int blue1 = 0,blue2 = 0;

void setup() {
  // Set S0 - S3 as outputs
  pinMode(A2,INPUT);
  pinMode(A1,INPUT);
  pinMode(enA, OUTPUT);
  pinMode(enB, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  pinMode(S0, OUTPUT);
  pinMode(S1, OUTPUT);
  pinMode(S2, OUTPUT);
  pinMode(S3, OUTPUT);

  // Set Pulse Width scaling to 20%
  digitalWrite(S0, HIGH);
  digitalWrite(S1, LOW);

  // Set Sensor output as input
  pinMode(sensorOut1, INPUT);

  // Setup Serial Monitor
  Serial.begin(9600);

  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
}
int det1 = HIGH,det2 = HIGH;
void loop() {
  analogWrite(enA, 255);
  analogWrite(enB, 255);

  // Setting RED filtered photodiodes to be read
  digitalWrite(S2, LOW);
  digitalWrite(S3, LOW);

  // Reading the output frequency
  red1 = pulseIn(sensorOut1, LOW);
  delay(100);
  red2 = pulseIn(sensorOut2, LOW);
  delay(100);

  // Setting GREEN (G) filtered photodiodes to be read
  digitalWrite(S2, HIGH);
  digitalWrite(S3, HIGH);

  // Reading the output frequency
  green1 = pulseIn(sensorOut1, LOW);
  delay(100);
  green2 = pulseIn(sensorOut2, LOW);
  delay(100);
  // Setting BLUE (B) filtered photodiodes to be read
  digitalWrite(S2, LOW);
  digitalWrite(S3, HIGH);

  // Reading the output frequency
  blue1 = pulseIn(sensorOut1, LOW);
  delay(100);
  blue2 = pulseIn(sensorOut2, LOW);
  delay(100);

  det1=digitalRead(A1);
  det2=digitalRead(A2);
if(det1 == LOW){
  delay(1500);
  Serial.print(red1);
  Serial.print(green1);
  Serial.println(blue1);
}
  if (red1 < green1 && red1 < blue1) {
    delay(1500);
    Serial.println(" - RED detected!");
    digitalWrite(in1, HIGH);
    digitalWrite(in2, LOW);
    delay(2000);
    digitalWrite(in1, LOW);
    digitalWrite(in2, HIGH);
    delay(2000);
  }
  if (green1 < red1 && green1 < blue1) {
    Serial.println(" - GREEN detected!");
  }
  if (blue1 < red1 && blue1 < green1) {
    delay(4000);
    Serial.println(" - BLUE detected!");
    digitalWrite(in3, HIGH);
    digitalWrite(in4, LOW);
    delay(2000);
    digitalWrite(in3, LOW);
    digitalWrite(in4, HIGH);
    delay(2000);
  }
else
  {
    digitalWrite(in1, LOW);
    digitalWrite(in2, LOW);
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);
  }
if(det2 == LOW){
  delay(1000);
  Serial.print(red2);
  Serial.print(green2);
  Serial.println(blue2);
  if (red2 <green2 && red2 < blue2) {
    delay(1500);
    Serial.println(" - RED1 detected!");
    digitalWrite(in1, LOW);
    digitalWrite(in2, HIGH);
    delay(2000);
    digitalWrite(in1, HIGH);
    digitalWrite(in2, LOW);
    delay(2000);
  }
  if (green2 < red2 && green2 < blue2) {
    Serial.println(" - GREEN1 detected!");
  }
  if (blue2 < red2 && blue2 < green2) {
    delay(4000);
    Serial.println(" - BLUE1 detected!");
    digitalWrite(in3, LOW);
    digitalWrite(in4, HIGH);
    delay(2000);
    digitalWrite(in3, HIGH);
    digitalWrite(in4, LOW);
    delay(2000);
  }
else
  {
    digitalWrite(in1, LOW);
    digitalWrite(in2, LOW);
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);
  }
}
```

COST ESTIMATION

S. NO	COMPONENETS	COST
1.	Arduino UNO R3	600.00
2.	IR sensor	150.00
3.	RGB color sensor	550.00 x2
4.	L298 Driver module	500.00
5.	Gear Motors	200.00 x4
6.	Pillow block	300.00 x10
7.	Rack and pinion assembly	200.00 x2
8.	Conveyor Belt	400.00
	TOTAL	7000.00 (approx.)

CONCLUSION

- The system offers a sustainable approach for processing the waste into individual units and then segregate them based on two colors.
- For an industrial approach, this can be further more developed with more actuators for multiple colors segregation and the separating fabrication can be enhanced more to divide multiple individual items at a time.
- We are certain that this system will reduce all the manual work, increase rate of segregation and encourage the textile industries towards recycling rather than discarding as landfill which would reduce a part of pollution.

FUTURE SCOPE

- This system that we have developed can be used only for segregation of the pre-production waste based on color but it can be furthermore developed to segregate the materials based on fiber or type of material manufactured.
- This could replace the existing system for material segregation based on types and combines both the process.
- Another function that can added to system is converting the segregated materials into the form of raw materials (i.e.) thread form. This process combined with other system can be developed into single recycling unit.

REFERENCES

1. Habich, U., 2007. Sensor-based sorting systems in waste processing. International SymposiumMBT.
2. Jordeva, S., Tomovska, E. and Trajković, D., 2015. Current state of pre-consumer apparel waste management in Macedonia. Fibres &Textiles in Eastern Europe, 23(1 (109)), pp.13-16.
3. Kulkarni, A.B., Jaisingpure, P.S. and Lenina, S.V.B., Automated Object Sorting Based On Color Detection.
4. Zhang, H., Liang, H., Ni, T., Huang, L. and Yang, J., 2021. Research on multi-object sorting system based on deep learning. Sensors, 21(18), p.6238