International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

# Picking Object By Using Robotic Arm

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**Abstract -** *The main objective of the project is to detect the color of an object based on its color and placed it in a specific location. For Pick and Placed purposes, Robotic Arm are used. Robotic Arms are one of the most important parts of today's world. The Robotic Arm is controlled by an ARDUINO NANO and using Servo Motor it is created. With the help of the Color Sensor, the Robotic Arm detect the object's color and placed it into the equivalent position. One of the most important advantages of using a Robotic Arm is to increase the efficiency, productivity, and precision of the operations taking place. In this project, the system categorizes the cube of two different colors. Using light intensity to frequency convertor method the detection of the particular color is done. With the help of the Conveyer Belt object travel from the start position to the end position. The Conveyor Belt starts automatically with the help of sensors. Conveyor Belts are used to reduce the time required for the transportation of material and increase productivity.*

***Key Words*: Robotic Arm, Conveyer Belt, Color Sensor, Servo Motor, Dc Motor, LDR, LASER Light**

## 1. INTRODUCTION

The importance of robotics in the 21st century is increasing day by day to reduce human mistakes in their daily tasks because of their ability to do many difficult tasks. We the humans know what we can do. What happens if we give a task to a person to sort the object based on color. Definitely, it will sort the object, since the person has to sort the object a single time. But when we say to a person that you have to sort the object multiple time then the person will lose its accuracy to sort the object, this will not give the same result as it was given early.

The solution for such a task is a Robotic Arm. The Robotic Arm performs a such task repeatedly with the same accuracy, it takes less amount of time. Robots can work both day and night, compare to a human who doesn't need sleep. The speed of the Robotic Arm can be changed using a program written on it.

Conveyor Belts are very important in industries, like manufacturing industries because transport of material is a very challenging task. Conveyors are used to reducing the time required for the transportation of material and increase productivity. The smart Conveyor Belt starts automatically with the help of LESER Light and LDR. These sensors detect the object as it comes to its start point, it will run up till the object reach its endpoint of the Conveyor Belt. At the endpoint the robotic arm gets triggered it picks the object, detects its color using a Color Sensor, and placed it in a particular location.

## 2. LITERATURE SURVEY

S. V. Rautu, A. P. Shinde, N. R. Darda,A. V.Vaghule, C. B.Meshram, S.S.Sarawade proposed a Low Cost Automation System for sorting colored objects on the basis of their color, weight variation and type. The project mainly focuses on sorting 2different weighing non-metallic objects which are available in 3 different color sensing load cell, TCS230 Color Sensor, inductive sensor and DC Geared Motors. The system consists of Conveyor Belt which takes the objects[1].

In Aji Joy reviews there are many color sensing ICs available today. In different ICs the properties vary such as color differentiating ability, output format, price, speed, resolution etc. In this project TCS3200 is selected. The TCS3200 is a programmable light-to-frequency converter that combines configurable silicon photodiodes and acurrent to frequency converter on a single monolithic CMOS integrated circuit. The output is a square wave (50% dutycycle) with frequency directly proportional to light intensity[2].

The Aung Thike, Zin Zin Moe San, Dr. Zaw Min Oo have to consider separating and placing the blocks according to their colors. The TCS230 color detector can measure three primary colors Red, Green and Blue and it also has a separate white light detector. Since any color can be created from different levels of these primary colors, the unit can tell you the color composition of a light source. Color blocks are used to test the project. The authors have to consider separating and placing the blocks according to their colors[3].

Vishnu R. Kale, V. A. Kulkarni proposed the servo turn rate, or transit time, is used for determining servo rotational velocity. This is the amount of time it takes for the servo to move a set amount, usually 60 degrees. For example, suppose you have a servo with a transit time of 0.17sec/60 degrees at no load. This means it would take nearly half a second to rotate an entire 180 degrees. More if the servo were under a load. This information is very important if high servo response speed is a requirement of your robot application[4].

Survey on Design and Development of competitive low-cost Robot Arm with Four Degrees of Freedom by Ashraf Elfasahany. In this paper the representation of the design, development and implementation of robot arm is done, which has the ability to perform simple tasks, such as light

material handling. The robotic arm is created and made from high quality acrylic[5].

Sharath Surati, Shaunak Hedaoo, Tushar Rotti, Vaibhav Ahuja, Nishigandha Patel have used 4 servo motors to make joints of the robotic arm and the movement will be controlled with the help of potentiometer. The arm has been built by the Cardboard and individual parts are attached to the respective servo motors. The arm is specifically created to pick and place light weight objects. So low torque servos, with a rotation of 0 to 180 degrees have been used. Thus the paper basically focuses on creating a robotic arm with non useful materials and its application on small purposes[6].

In Muhammad Naufal Bin A Rahman, Zol Bahri Razali reviews the structure of the Conveyor and Robotic Arm was formed by three sub-assemblies for Robotic Arm namely gripper assembly, elbow assembly and arm assembly. This type of modular design is efficient in the sense that it enables easy replacement of parts and components during maintenance of device. Also, it helps in providing comprehensible design concept and thus, machines and devices with modular design are easier to be assembled and managed because of this advantage[7].

Dr. Reg Pecen proposed Conveyor Belt prototype is heavily constrained to maintain the cost within the limited budget provided to students. For an industrial equivalent of a real system, an ideal motor for a similar project would be a 3-phase induction motor to provide a high starting torque, good speed regulation, and reasonable overload capacity. The proposed modular Conveyor Belt system starts up with both Robotic Arms actively looking for a specific universal product code (UPC) of the functional block diagram. Once a barcode has been found, the reader will look within the ARDUINO microcontroller's code to find the predetermined location in which the box will be placed[8].

Utkarsh Kamble, Shubham Paturkar, Pooja Swami, Shivam Malwade, M. S.Dholkawala, Anand Bhise provides to design the conveyor system used which includes belt speed, belt width, motor selection, belt specification, shaft diameter, pulley, gear box selection, with the help of standard model calculation. During the project design stage for the transportation of raw materials or finished products, the choice of the method must favour the most cost-effective solution for the volume of material moved; the plant and its maintenance; its flexibility for adaptation and its ability to carry a variety of loads and even be overloaded at times[9].

Jaroslav Homišin, present effective value of vibration (RMS) and CREST factor for analysis of vibrations in conveyors. Because of the continuous use of conveyors, it is important to consider vibrations while designing the conveyors to avoid failure due to vibrations[10].

ER. Rajput, in this book the operation and control of robots is discussed. ARDUINO cookbook, in this book details and methods of interfacing hardware components such as DC Motor, Servo Motor and RF Transmitter and Receiver is been discussed[11].

In Amir Deshmukh, Mahesh Nagane, Vaibhav Awatade reviews as a color is an interaction between a very small range of electromagnetic waves and the eyes and brain of a person. What people call red, green, or blue are just ways of categorizing what their brain experiences. Light is a type of energy, which makes up a small portion of the electromagnetic spectrum. The region of visible light consists of light with a wavelength between approximately 380 nm to 780 nm[12].

## 3. BLOCK DIAGRAM

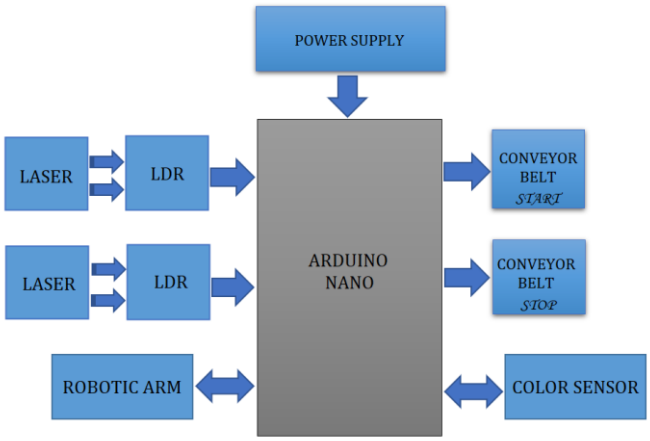



**Fig -1**: Block Diagram

## 4. DESCRIPTION

As we know that for any circuit to work correctly it needs a well and constant power supply. In our case, we have used the adapter which takes 230v ac input and outputs 5 Volt 1 Amp of current this adapter is used to power the DC Motor of the Conveyor Belt, and one more adapter is used to power the Robotic Arm and Color Sensor system. For the ARDUINO NANO to work we use the same power supply.

Two ARDUINO NANO are used in this project. One for controlling and carrying out a task with the Conveyor Belt and another for the functioning of the Color Sensor and Robotic Arm.

Conveyor Belt is most important in this project. It is used to move the object from the start position to the end position. Conveyor Belt reduces the time of transportation of objects. The Conveyor system is formed with the help of the DC Gear Motor and with the use of a sensor formed by the LDR and LASER pair. LASER Light continuously emits on LDR, which helps the start and stop of Conveyor Belt. For smooth working of Conveyor, we use small light weight-bearing to form roller. Over which belt rotates freely. This whole system is controlled by the ARDUINO NANO.

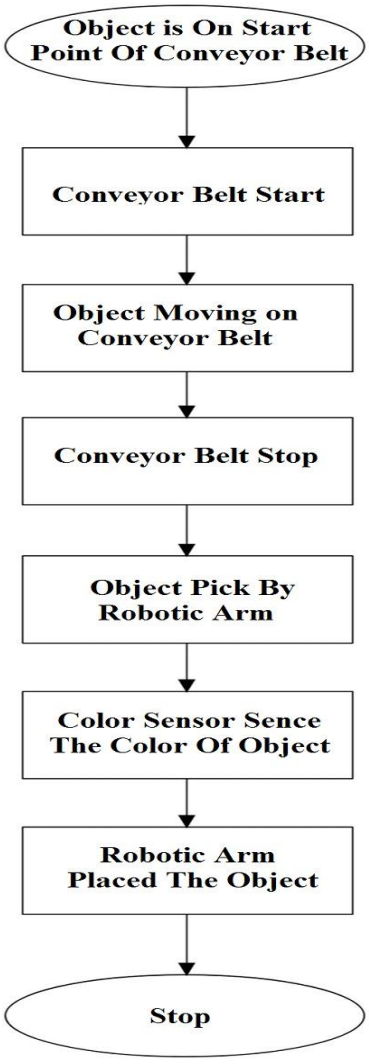
Another system is the Robotic Arm and Color Sensor. They both are controlled by NANO, Robotic Arm is formed such that it is light weight and can move freely. The four Servo Motor makes the Robotic Arm pick the object and left it and move it to the desired position.

The Color Sensor reads the color and gives a signal to the controller about where should the arm drop the object. The object is covered with color paper so that the Color Sensor read the color properly and based on the color the object is dropped to a particular position.

The timing is fixed for the functioning of processes to a 92 percent accuracy. As if the object color detection is missed then the system wents to 40 percent accuracy as the light reflection hampers the system. This can be overcome by using the system under low sunlight conditions.

## 5. FLOW CHART

This flow chart gives the actual overview of, how the system is going to work.




## 6. WORKING

**1)** First of all the object comes at the start position of the Conveyor Belt, at that point object crosses the path between LASER light and LDR, due to which the object blocks the path, which causes the resistance will decrease in LDR. This decrease in resistance is read by the ARDUINO and starts the Conveyor Belt.

**2)** Object travels on the Conveyor Belt and reaches the endpoint. The object once again crosses the path between LASER light and LDR, and another time resistance decreases which results, the Conveyor Belt automatically stopping.

**3)** When the Conveyor Belt will stop, at the point the Robotic Arm gets triggered and the Robotic Arm picks up the object. Then the Robotic Arm moves the object towards the Color Sensor.

**4)** Since the Color Sensor is used to find or detect the color of the object. A Color Sensor can detect the received light intensity for red, blue, and green respectively, making it possible to determine the color of the target object.

**5)** According to a program which is written in the ARDUINO NANO, there is a particular location for every color. The ARDUINO NANO gives the command to the Robotic Arm, to place the object in a specific location, and the Robotic Arm places the object.

### 6.1 OBJECT MOVING

The Conveyor Belt is designed such that it starts only when the object comes to its start point. This is done with the help of two pairs of LASER and LDR. One pair of LASER and LDR is situated at the start point of the conveyor which is placed on the sidewall of the conveyor assembly and another pair is on the endpoint of the conveyor just like the one which is at the start point.

This makes the conveyor smart and energy-efficient. Its starts and stop working automatically. The Conveyor Belt is driven by a DC Gear Motor. This DC Gear Motor provides the essential torque which helps the Conveyor to move smoothly.

There is a gap between the conveyor and side walls. This gap is responsible for the proper flow of air. This will keep the system cool which will help the system to give better performance.

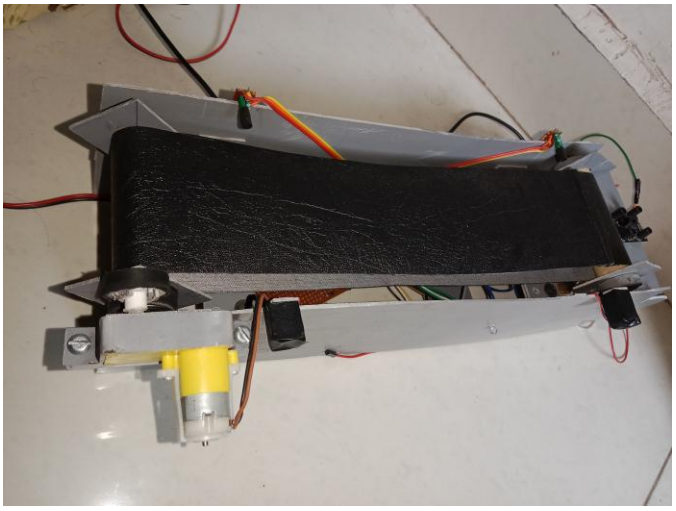


**Fig -2**: Conveyor Belt

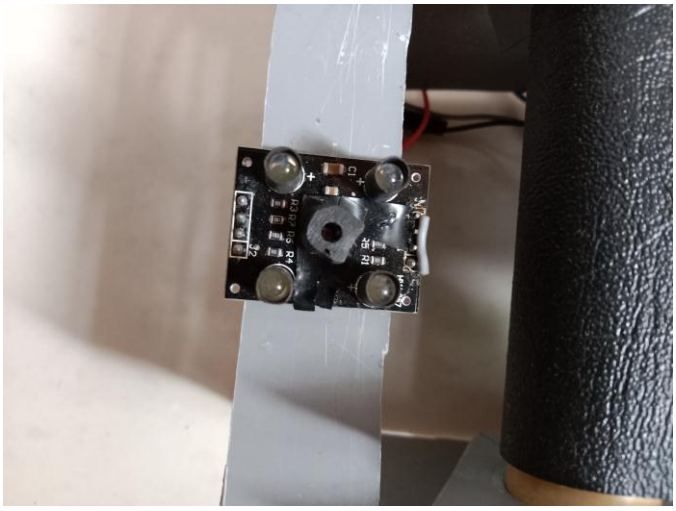


**Fig -3**: Color Sensor

As the object crosses the start point where the LASER and LDR are present it blocks the LASER which is falling on the LDR and then LDR resistance decreases, this decrease in resistance is measured in the form of voltage change (voltage divider principle is used)and then the NANO decides to start the Conveyor until an unless it reaches to the endpoint of the conveyor. As it reaches its endpoint again the object crosses the endpoint where the LASER and LDR pair is present. The same procedure happens here which happens before but for the Conveyor Belt stops. In this way, the object reaches the end of the Conveyor Belt.

### 6.2 COLOR SENSING

To connect the Color Sensor to the ARDUINO NANO we use male/female wires. The sensor works by taking three different readings indicating the relative " Strength" of the three primary colors, we can figure out any color as they will just be different Mixes of Red, Green, and Blue.

Which color we want to Red depends on the voltage you write on the s2 and s3 pins, according to this table.

| S2 | S3 | COLOR READ |
|---|---|---|
| 0 | 0 | RED |
| 0 | 1 | BLUE |
| 1 | 1 | GREEN |

To make a measurement, we need to select which color strength we want to read by doing digital writes to pins s2 and s3 according to the pins above. Then we read the color strength on the sensor out the pin, which we have connected to ARDUINO Pin. To make the measurement, we need to make a PulseIn measurement at our Pin of the sensor.

The PulseIn measurement :

Is an ARDUINO command that looks at the Pin you specify, looks for a pulse, and returns a number representing the length in microseconds of the pulse seen at the pin specified. This measurement will return a value between 0 and 102400. The lower the number, the stronger the color is read. The larger the number, the weaker the color.

Since our RGB LED accepts values bet 0and 255. To get these values we map the reading such that it gives values between 0 and 255. This is the example to read RED color. We repeat the above steps changing the state of s2 and s3 to read blue and green and finally, we get the desired color output through RGB led.

### 6.3 PICK AND PLACE

The Robotic Arm consists of a square shape base upon which the whole Robotic Arm is placed. It consists of "v " named base servo which is used to change the direction or rotate the Robotic Arm in a clockwise or anticlockwise direction since the rotation is restricted because the Servo Motor used works between 0 to 180 degree and practically due to the load of Arm and object it works in the range of 0to 160 degree.

The next Servo Motor is "x" which is responsible for moving the Arm up and down the Arm and the next servo "y" is connected to this Arm which has another Arm that consists of a gripper that has another servo "z".

The "x" name servo and "y" name servo works in such a manner that the movement of the Arm resembles the movement of the Human Arm.

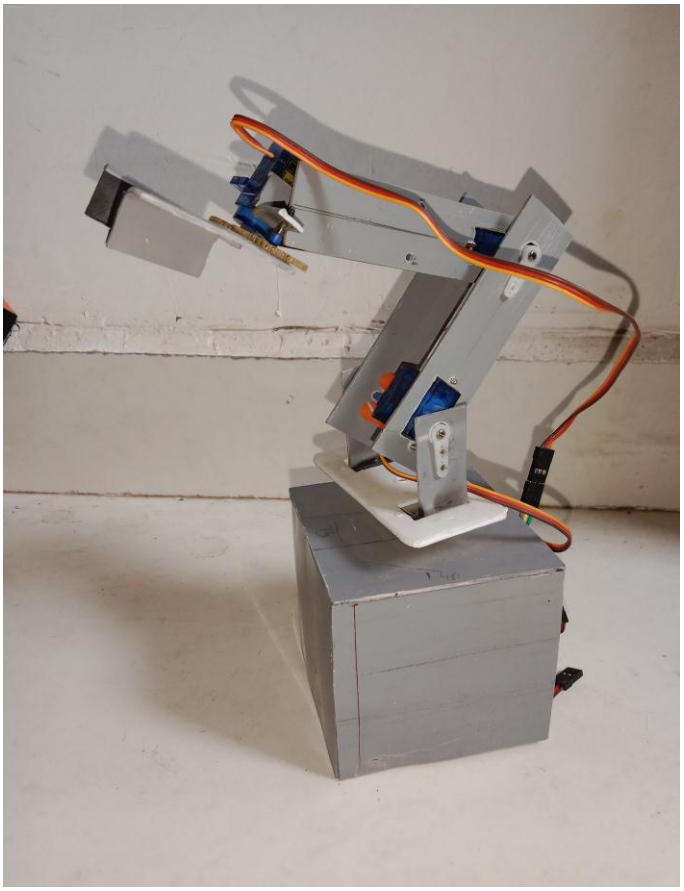


**Fig -4**: Robotic Arm

The object when comes to the endpoint due to a specific time delay the Robotic Arm starts to work it picks and left the object and is placed in front of the Color Sensor which is mounted on the conveyor endpoint. The Color Sensor detects the color of the object and then based on the color the Robotic Arm place the object in its desired location.

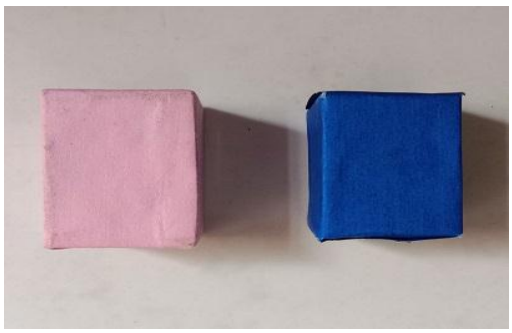


**Fig -4**: Color Cube

## 7. APPLICATION

The system has many applications in various fields, as this system provides the sorting of objects and inflow of objects by multi-sensing.

Mainly this finds an important application in the agriculture field where it can be used to sort the different agriculture products like grains, lemons, almonds, grapes, and many more.

The human cannot detect multiple colors fastly and here the accuracy is less in case of human being ,therefore for sorting the objects we can use this system.

In industry, it can be used for sorting various objects, and tools, with a high degree of accuracy and quality with automation.

It will decrease the human efforts.

## 10.CONCLUSIONS

The project aimed to have a fully functional Conveyor Belt with the Robotic Arm which sorts different colored objects and the target is achieved successfully. In the final run of the project, Blue and Pink cubes were successfully sorted. The Color Sensor IC TCS3200 shows an almost stable response in low light conditions. The robotic sorting systems are useful in industries and different household activities. It can be improved by using a more advanced Color Sensor and Microcontroller. The system can successfully perform handling station tasks, namely the pick and place mechanism with help of a sensor. Thus a cost-effective system can be designed using the simplest concepts and the efficient result can be observed.

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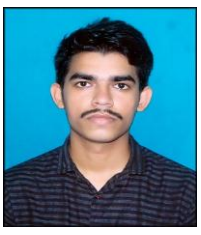

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