

IMPLEMENTATION OF THE SYSTEM FOR COLOUR DETECTION AND IDENTIFICATION USING ROBOTIC ARM: A REVIEW

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Abstract : The work shows how the colour identification and sorting of an object is done based on the intensities of different coloured objects with the help of robotic arm and different sensors. The objective of the project is to design a system which is efficient in sorting the things in order to minimize the human error and time in the applicable area. For programming purpose, the controller used is Arduino Uno (ATMEGA328P) and PIC, Raspberry Pie (ARM processor), MATLAB are also some of the controllers used. The paper also describes how the TCS230 (colour sensor) detects the objects colour and process the information to the Arduino for the sorting mechanism. The robotic arm is controlled by a DC servo motors through a motor driver L293D.

IndexTerms – Arduino,Robotic Arm,Colour sensor, Servomotor.

I. INTRODUCTION

Within the era of accelerating increasing technology, robots have dominated humans in every aspect be it in day-to-day life. The man power is being replaced by the robots in every area that their performance and efficiency is not even been matched by the human beings. The main reason that the industries growing rapidly in terms of performance as they are deploying robot's with fully automated which aims to complete the tasks on time without error. The robotic revolution has opened the way to help the handicapped people so that they can reclaim the use of lost limbs.

The purpose of this project is to analyse how a robotic arm can respond to objects of different colour, then grip and sort them depending on the colour identification. Though robotic arm system has already been implemented in sophisticated cases, still the technology is considered as a colour sorting system with robot arm that will be operated using a computer/interfacing IC and controller.

Embedded c programming language has been used to communicate with the Arduino. The main objective of this work is to sort the thing consistent with their colour employing a colour sensor and also to sort the thing to the station accordingly. After determining the colour of the thing, the robot arm system will make its own decision to the objects to their respective locations.

II. METHODOLOGY

2.1 Flow Chart :

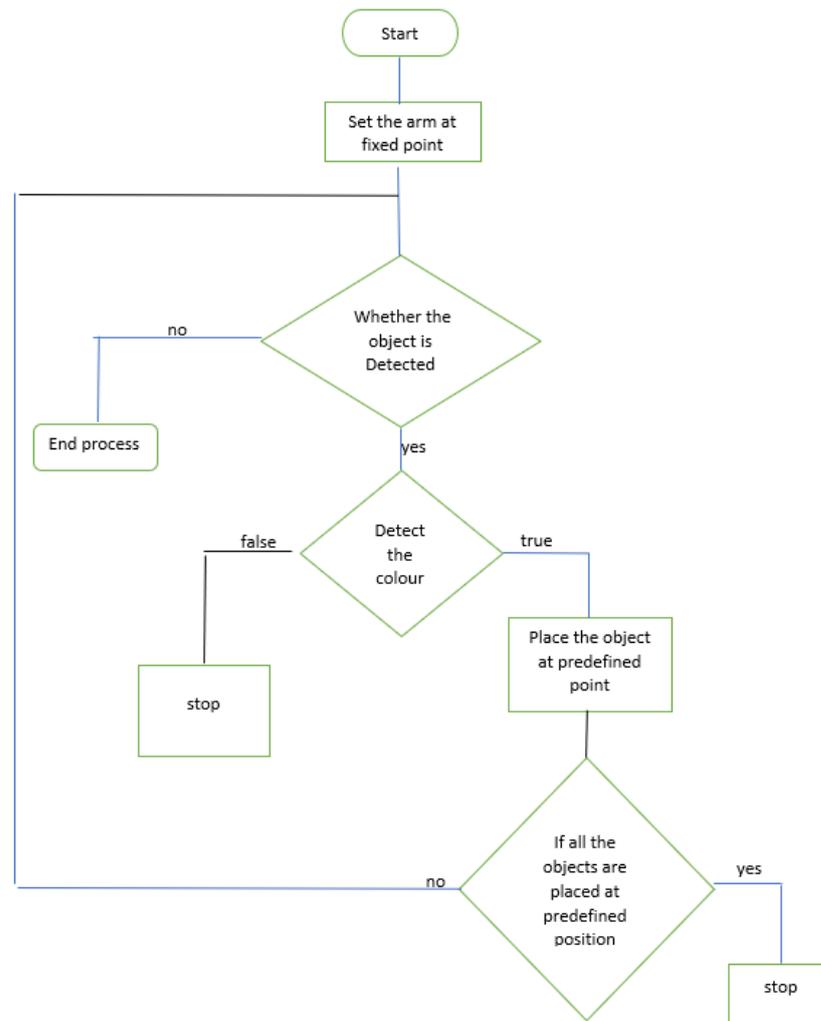


FIG 2.1.1

Colour sorting robotic arm is a system having a capability to select the specified colour object and placed it at a desired location. Firstly, when object is determined by the robot, the gripper of the robot will pick the object and place it to the specified colour differentiating station. TCS 230 is an array arrangement of configurable silicon photodiodes and frequency converter mounted of the chip in the form of a CMOS integrated circuit on RGB colour sensor.

An 8*8 matrix of photodiodes within the device with sixty-four filter sensor units are employed in it. All these filter units are collected RGB (red, green, blue) data from the supply. The information collected from the sensor unit is transformed into square wave of half duty cycle by an oscillator which is integrated in the chip. This wave is then sent to the microcontroller directly.

Microcontroller transfers signals to the motor driver to activate the arm to select the object and drop it to the place outlined defined by programming of controller. The robotic arm then rotates to the specific angle (may be 90° , 120° , 270° or 360°). The selection of output frequency is done by terminals S0 and S1, while the colour selection task is accomplished by the photodiode output terminals S2 and S3.

TABLE 2.1

S0	S1	Output Frequency Scaling (f_0)
L	H	2%
L	L	Power Down
H	H	100%
H	L	20%

TABLE 2.2

S2	S3	Photodiode Type
L	H	BLUE
L	L	RED
H	H	Green
H	L	Clear (no filter)

III. COMPONENTS USED:

1. TCS 230 colour sensor
2. Infrared sensor
3. Arduino Uno
4. Servomotor SG90
5. DC motor
6. Conveyor Belt

3.1 TCS 230 Colour Sensor:

TCS230 sensor senses RGB and white. TCS230 was selected as the sensor because of its accurate and well formatted output. The speed of detecting the colours is very fast and it has an array of photodetectors, each with either a red, green, or blue filter, or no filter (clear). The filters of each colour are distributed evenly throughout the array to eliminate location bias among the colours. On the inside of the device there will be an oscillator which produces a square-wave output whose frequency is proportional to the intensity of the colour chosen.

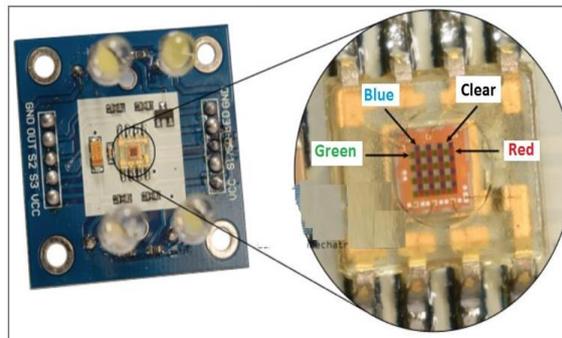


FIG 3.1.1

3.2 Infrared Sensor:

Infrared sensor plays an important role in the project. The led which is in white colour is the transmitter of the sensor which emits the infrared radiations and the led which is in the black colour is the receiver of the sensor which receives the infrared rays in the form of photodiodes (detects the intensities of the reflected rays and gives output). Both the led's plays equal role in detecting the object as they depend on each other if one doesn't work the IR sensor fails to give the information to the Arduino.



FIG 3.2.1

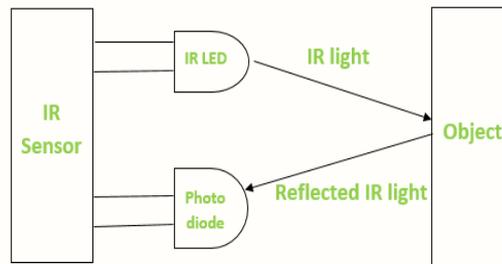


FIG 3.2.2

3.3 Arduino Uno:

Arduino is the heart of the entire unit where all the components are connected through it. It takes the information given by the IR sensor and sends it to the servomotors for the pick and place mechanism.



FIG 3.3.1

3.4 Servomotor SG90:

The pick and rotation mechanisms are done by the servomotor. Servo motors are high torque motors which are mostly used in robotics and many other applications due to their easy rotation control. Servo motors have a geared output shaft which can be controlled electrically to turn one degree at a time. The shaft of a servo motor can be rotated at any desired angle by using the two pins which are basically Vcc and Gnd.



FIG 3.4.1

3.5 DC Motor & Conveyer Belt:

DC motors are used to move the objects on the conveyer belts. The power supply to the dc motors is to be given separately as the Arduino cannot drive the motors. The objects are placed on the conveyer belt so as to be detected by the IR sensor.

IV. WORKING:

The sorting is done by colour sensors, a photodiode of 8*8 matrix is used as a colour sensor. The colour sensor detects the colour of the object based on the **RGB** colour model which includes a wide range of colours. The microcontroller is main component which controls entire part of the unit.

The output of the photo sensor is given as input to the microcontroller which analyses the intensities & controls the functions of rest of the blocks of the system. In order to pick the object, robotic arm driven by servomotors are used and the objects are placed at a specified location according to the colour of the object.

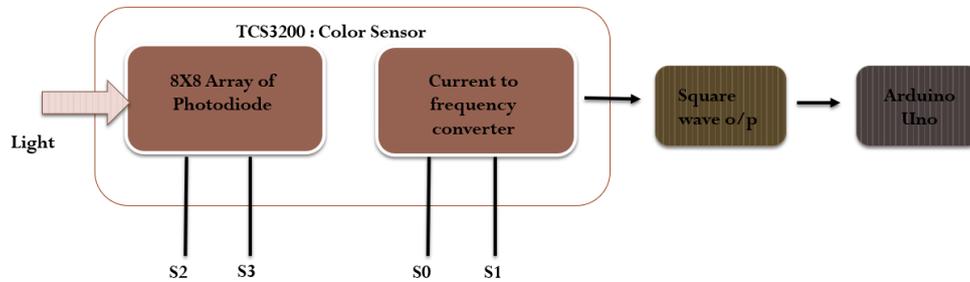


FIG 4.1

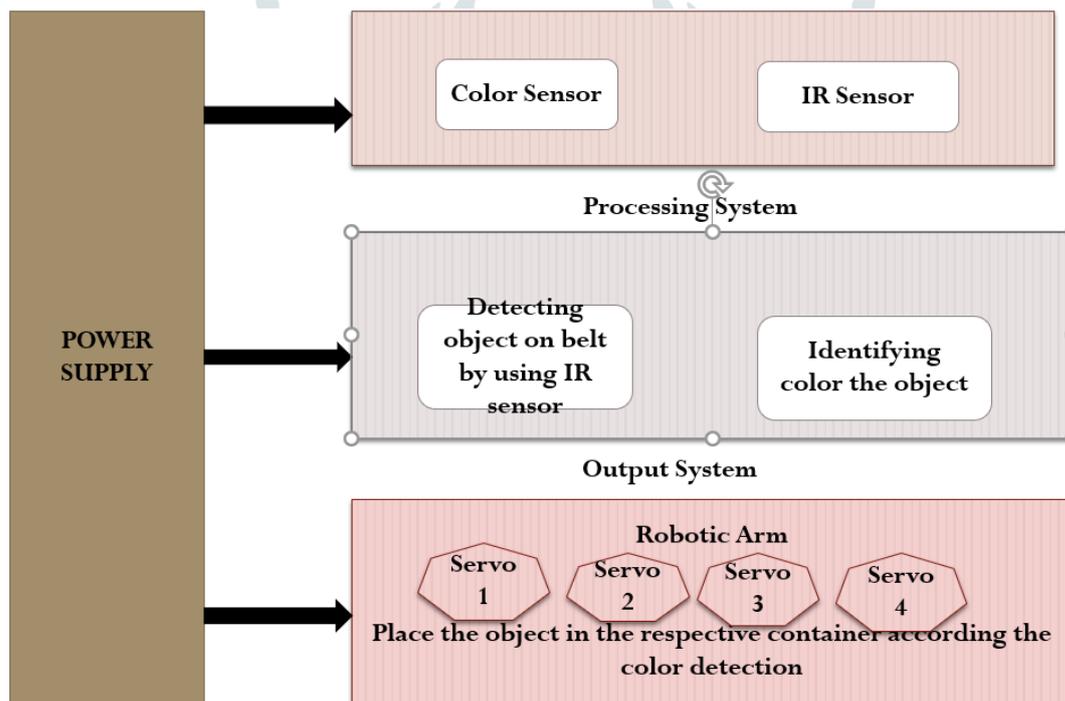


FIG 4.2

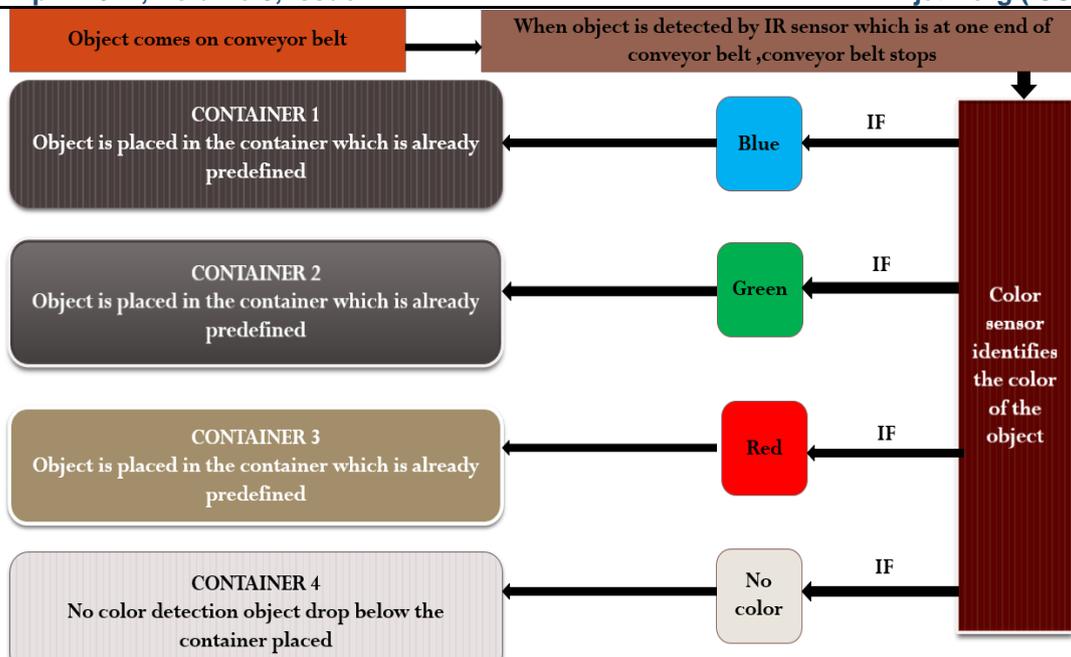


FIG 4.3

V. Comparison of different controllers:

Controller	Performance	Programming	Speed	Cost	Power supply
1.Arduino	Equivalent to Raspberry pie in case of single tasking but in case of multitasking Arduino cannot compete with Pie.	Arduino IDE, programming can easily do with the help of pre-existing libraries. (C/C++)	The clock speed of Arduino is 16MHz.	The cost is less.	Powered using computer USB port
2.Raspberry Pie (ARM processor)	Equivalent to Arduino in case of single task & also it is used for multitasking purpose.	High level language like Python, (C/C++) which will be a little tough as it depends on the hardware.	The clock speed is 1.2GHz	The cost is high compared to Arduino.	It requires USB adapter.
3.Matlab	High.	Depends upon the project.	The speed is similar to others.	It has both free & paid versions.	It is a Pc software.
4.PIC	Performance is high.	Simple coding.	Speed is high.	The cost is less	Uses low power.

TABLE 5.1

VI. MODEL:**FIG 6.1****VII. APPLICATIONS:**

The system is used in various fields as its main objective is colour sorting of the objects. One best example is separation of the vegetables using pick and place mechanism by the robot. Separation of different kinds of nuts and bolts in industries in order to reduce the efforts made by humans. It can also detect the defected ones in a batch of good ones. For human beings it is a tiresome task to sort the objects with efficiency and high quality, which leads in lack of accuracy in the job.

VIII. CONCLUSION & FUTUR SCOPE:

The paper represents the implementation of a system which can sort the colours of an object by a robotic arm as one of its application based on the pick and place mechanism. The paper shows the sorting of the object which is done by programming the robotic arm to rotate at a specific angle. This can be modified that it can be used for sanitation purpose and it can also lift the weights if some modifications are changed in programming. Soldering is also one of the areas it can be used with automation to avoid harming.

IX. REFERENCE:

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