

A Constructive Approach for Colour Objects Sorting Robotics Model by Using Programmable Colour Light-To-Frequency Converter Method

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***Abstract---**A robotic model is basically a combination of mechanics and electronics, communally it is called as Mechatronics. The design and implementation of a robotic system is performed by comprising a coloured object detection and arranging it consequently. The tri-colour objects i.e. of Green, Blue and Red, are recognized by means of sensors. The arms of the robotics are controlled by multiple motor for separating them. Light to frequency converting technique is employed for detecting multi-coloured objects on the basis of programmable module such as TCS230. The robotic system as of autonomous that is capable of performing every activities by its own by supplying required power. The maximum employment of this type of robotics are in the industrial sector for automatic and intelligence working of machines.*

***Index Terms---**Photodiodes, DC motors, Robotic arms, Object selection, Arduino UNO, Arduino IDE.*

I INTRODUCTION

In present era, the robotic model requires an absolute combination of mechanics and electronics which collectively termed as Mechatronics[1]. Mechatronics aids in the continuous growth of the present technology. The Mechatronic system not only improvises the commercial products whereas it also influences the in robotics. As of introducing the Mechatronics system the monitoring and controlling of the robotic models became very suitable and performs better modification. In this work a brief knowledge of an architecture of the robotics with the strong programmable platform is provided[2]. An autonomous model of robotics that are able of detecting and sorting by means of its colours being constructed. The first step deals with detecting colour by employing “colour detecting sensor” preferably as TCS230, particular sensor is capable of sensing colour by means of 8*8 array of the photo[3]. The “TCS230 colour sensor” works on the principle of dividing it into two blocks i.e. “current to frequency converter block” and “array block”. The block of an array aids in the detection of the colour and another block aids for converting the sinusoidal input into square wave. The converted square wave is further feed into the Arduino[4], the programming of Arduino is performed as such that the arms of the robotics either accepts or rejects the objects on the basis of the colour, the testing is performed for the two colours only i.e. of Red and Green, for Green the accepting option was selected and for Red rejection option was selected. The movement of the robotic arms helps in sorting the objects on colour basis, consists of

two servo dc motor that is able of moving 360o. The designing of the robot is performed such as it is capable of self-sorting of objects precisely and intelligently as per requirement.

II EXPERIMENTAL MODEL

The block diagram of the model that sorts the objects on the basis of colour difference by robotic arm as illustrated in Figure 1. The construction of robotic arm constitutes of very basic elements. The valuable component for the arms of robot are dc motors embedded in the model. Two joints of the robot are controlled by two dc motors that controls the arms in 360o[5]. Another motor on the robot for moving the arms vertically. Essentially the three motors in this model of robotics for its arms, for sorting of green led and red led only one motor is programmed. The programming of the motor is performed so that the rotation can be of clock-wise and anti-clock wise. The Arduino is associated with the lower part of the robotic arm. Further detecting objects colour by means of a sensing mechanism had been constructed that consisting of colour sensor TCS230 encloses in a compartment, the design of cabinet is open from upper part. The upper cabinet visible area can be used as a window cabinet for placing the objects that has to be detected.

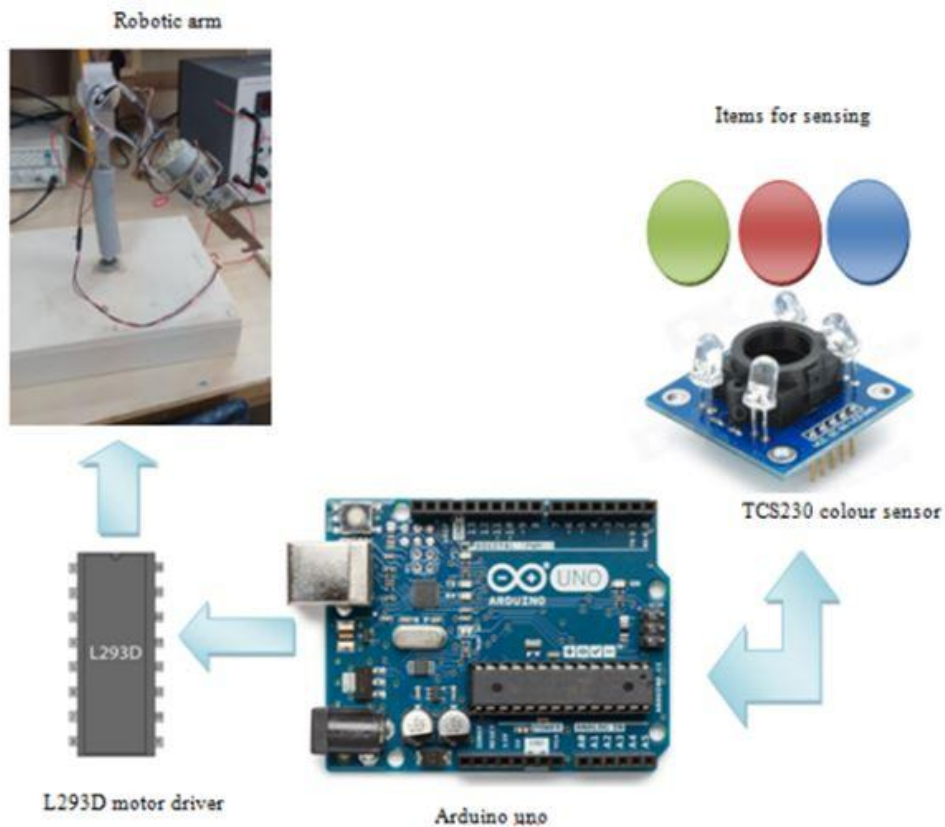


Fig. 1: Block diagram of the system

The software and hardware module by the model as illustrated below:-

III. Hardware Modules

The elements employed in this model as mentioned below:-

- Arduino: Arduino's are an open-source platform designed on the basis of easy-to-use software and hardware. These boards are capable of reading inputs of analog as well as digital. The instructions are programmed as per the sensor requirements. Arduino IDE was used for programming the Arduino[6]. It is used worldwide for the for the project and invention purposes by different communities. ATmega328 is employed for the construction of the Arduino Uno. "It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connector, a power jack, an ICSP header, and a reset button". It is fulfilled with the normally required units that supports microcontroller. It can be simply connected to the computer by means of USB cable and it can be started with a 5V DC power supply either from adaptor or the battery for its working. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0".

- TCS230: It is a "programmable colour light-to-frequency converter" constructed with in combination of the silicon photodiodes on "single monolithic CMOS integrated chip". The outcome of this sensor is square wave with proportional frequency to the light intensity[7]. It has 50% duty cycle. Output pins enable the multiple sharing of microcontroller input lines. 8*8 PV photodiodes array has been read by this converter. Total 64 photodiodes are employed in this model out of which 16 are of Red in colour, other 16 of them are Blue in colour, and 16 of them are of Green in colour and another 16 are whitish in colour that has no filters. For decreasing the effect of the incidence irradiance different types of photodiodes are employed in this model. The similar type of the 16 photodiodes are connected in parallel for the pin-selectable functioning effect. These photodiodes are 120mm * 120mm of size and 144mm from centre.

II.II. TCS230 WORKING BLOCK DIAGRAM

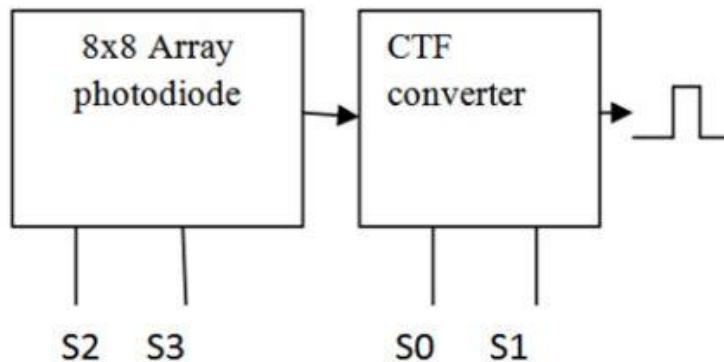


Fig. 2: Functional Bock diagram of TCS230

Table 1: Selectable Option in TCS230

| S0 | S1 | o/p frequency | S2 | S3 | Photodiode Type |
|----|----|---------------|----|----|-----------------|
| L | L | Power down | L | L | Red |
| L | H | 2% | L | H | Blue |
| H | L | 20% | H | L | Clear |
| H | H | 100% | H | H | Green |

- L293D: The L293 and L293D are the increase fourfold current H drivers. The L293 IC provides bidirectional flow of current of 1A from the voltage range 4.5V to 36V. The 293 D IC is constructed for providing bidirectional flow of current of 600mA at voltage range of 4.5V to 36V[8]. These two components are constructed for driving inductive loads like solenoids, bipolar and dc motors, relays and other high voltage/current loads in the applications of the positive supply. On the other hand “inductive transient suppression” can be attained by L293D with employing external output clamp diodes. The terminal of the Vcc1 is separated from Vcc2 by logic inputs for the minimization of the power dissipation of the component.

- DC Motors: This is employed in the system for the mechanical movement. Motors uses electrical energy and further converts it into mechanical energy[9]. Electric motors are employed for driving multiple of the devices on the daily basis. The usage of the small motors are in robotics, automobiles, blenders and other power tools.

Complete circuit diagram of the system is shown below:

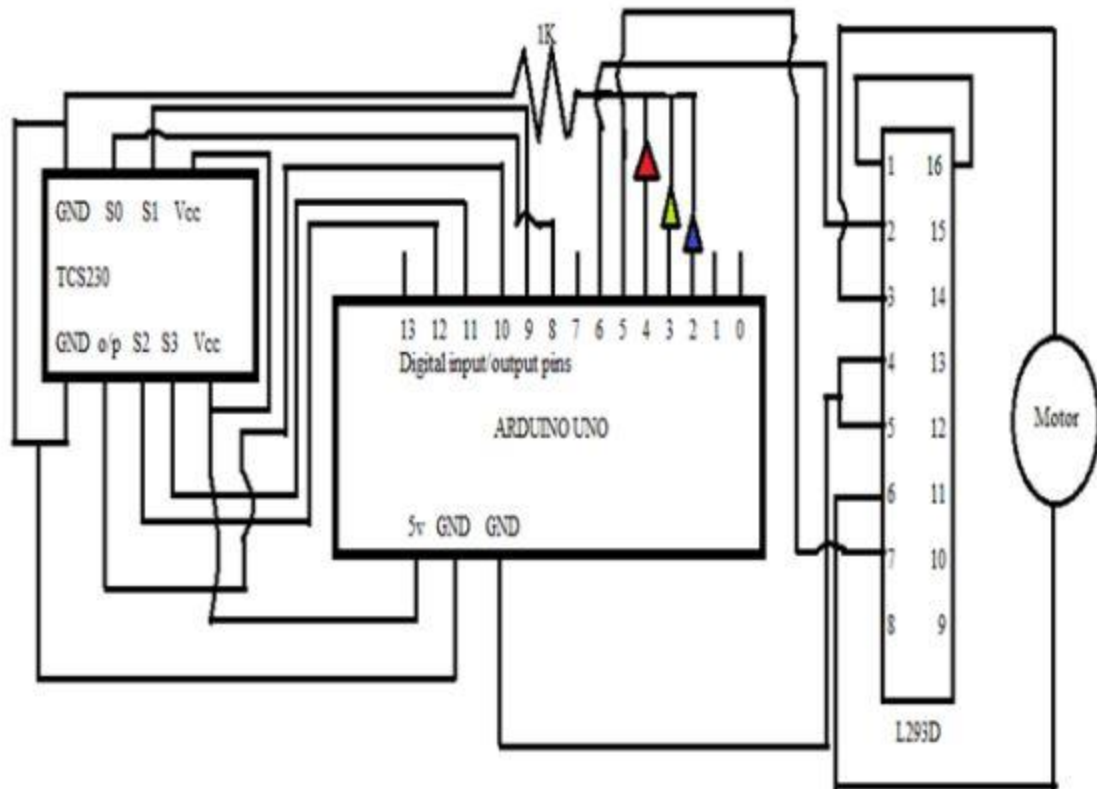


Fig. 3: Complete Circuit diagram of the system

II.III. Software Modules

The Arduino IDE[10] (Integrated Development Environment) that consists of text editing for writing programming codes, a text consoles, a toolbars with multiple buttons for common functioning of menus. It provides a connection with Arduino to the Genuino hardwares for uploading programs and communicating it. The programming performed by IDE is termed as sketches. It is written into text editors and being saved into the “.ino” extension. The text editors are featured with pasting/cutting and replacing/searching texts. The area of message provides feedback while exporting and saving and it also shows errors.

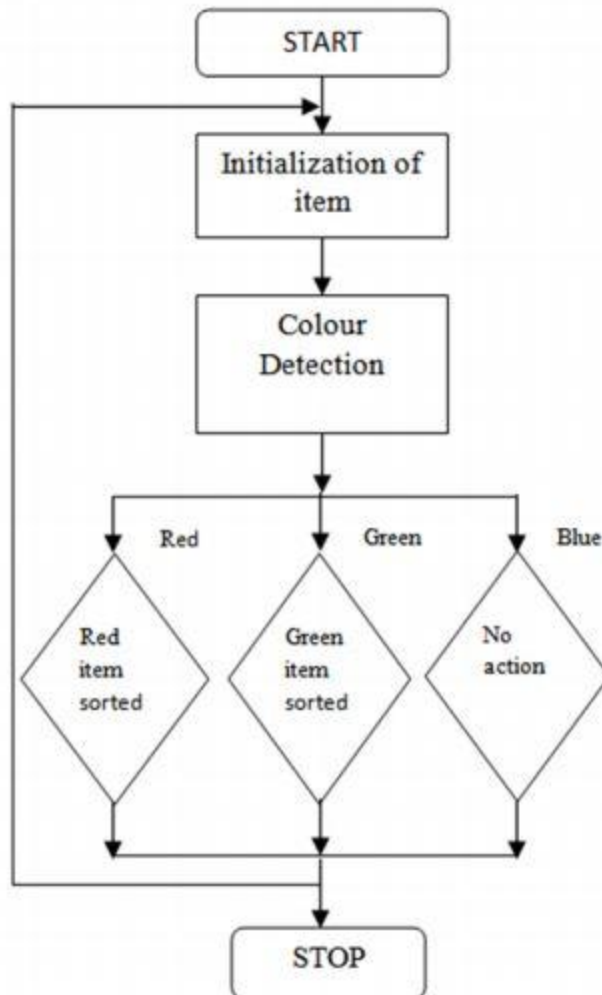


Fig. 4: Flowchart of the programme.

III WORKING METHODOLOGY

The function of the robotic arms are classified in two main sections, wherein the first section consisting of the detection and sensing of colour and second section function the sorting of the items by means of the robotic arms as per sensed colours. The TCS230 sensor is herein programmed for only two colours i.e. of Green and Red. Firstly the objects are placed on the visible area of the sensor, then the sensor sense its colour and lights by the aid of 8*8 array of the photodiodes. Then the current to frequency converter converts the reading of the photodiodes into the square waves as frequency directly proportional to the intensity of the light. Finally Arduino receives the converted square waves. Thereafter the sorting of the objects are performed with the help of the robotic arms that consists of three dc motors. The motor driver IC L293D is employed for driving motors. The Arduino is programmed in such a way that with the sensing of green colour the green objects will be placed into the green bucket and this process takes 2-4 seconds for sorting single object and same for the Red colour object with the aid of Red colour detection. And the detection of colour other than programmed colour has no effect.

IV DISCUSSIONS AND RESULTS

The constructed robotic arms are capable of sorting three colours with aid pf detection of colours i.e. Blue, Red and Green. But the programming is performed for two colours i.e. of Green and Red and sorting can be performed of two

colour by detection of these two colours by employing motors into the robotic arms in both anti-clock wise and clock wise directions. The response time of the movement of the arms are 0.12 secs. The robots are frame accomplished for utilizing headway as a part of the innovation in mechatronics field.

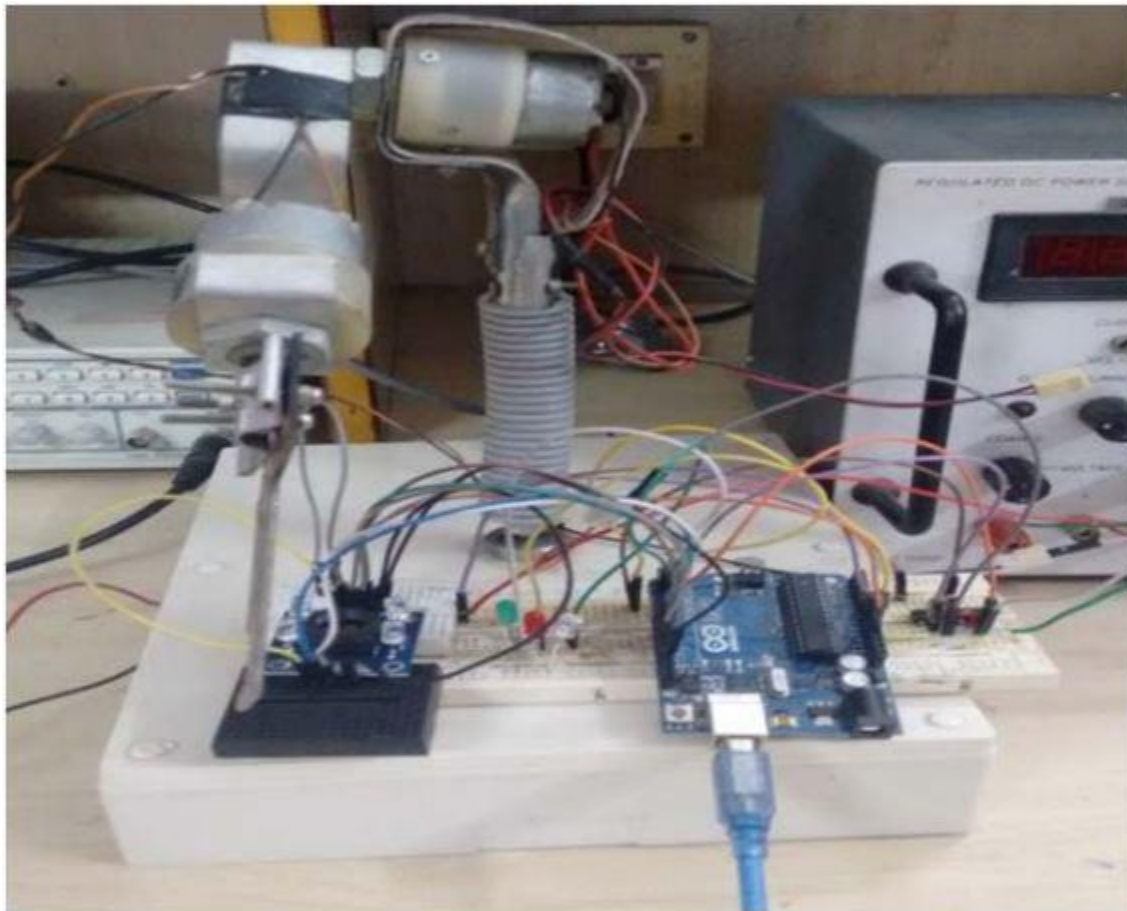


Fig. 5: Snapshot of the Robotic arm in operation

V CONCLUSION AND FUTURE ASPECTS

The tested model is extremely stable it achieves its task very precisely. The model established can be used vastly for the sorting of objects on the basis of colour and it can be modified as per the requirement. It is very useful for the sorting of the objects on the basis of colours and further can be on the basis of anything such as size and the mere differences as brightness etc. More arms can be added for increasing the efficiency and decreasing the time of the work.

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