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COLOUR SENSOR BASED OBJECT SORTING ROBORT USING EMBEDDED SYSTEM

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Abstract: This paper presents an application to sort colored objects with a robotic arm. We have a robotic arm which picks different colored cubes and sorts them placing in different cups. The detection of the particular colour is done by a light intensity to frequency converter method. The robotic arm is controlled by a microcontroller based system which controls DC servo motors.

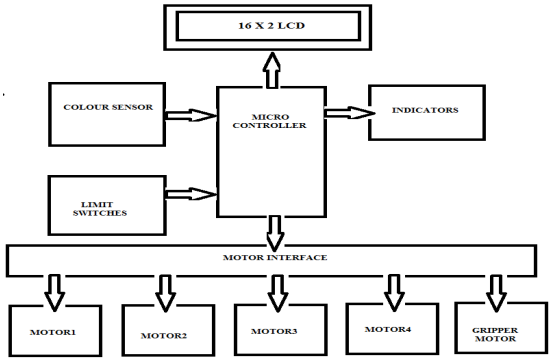
Keywords: Robotic arm, Microcontroller, Light to frequency converter, DC servo motor.

I. INTRODUCTION

A robot is a virtual or mechanicalartificial agent. In practice, it is usually an electro-mechanical machine which is guided by computer or electronic programming, and is thus able to do tasks on its own. Another common characteristic is that by its appearance or movements, a robot often conveys a sense that it has intent or agency of its own. Although the appearance and capabilities of robot vary vastly, all robots share the feature of a mechanical movable structure under some form of control. This control of robot involves three distinct phase- perception, processing and action. In common the preceptors are sensors mounted on the robot, processing is done by on-board microcontroller or processor and task (action) is performed using motor or with some other actuators.

Here we introduce a new project named object sorting robot, this robot is used for pick the object from one place and place that objects in required boxes with respect to its color. Some industrial works are harmful for humans this robot is mainly used for reduce the risk process and consuming time and avoid labors. It is build by microcontroller, DC motor and color sensor. The arm's end, reflector, is capable of picking and releasing both wet and dry objects.

II. PROPOSED SYSTEM



Photodiode based color sensor is attached with this system for detecting the color of the object. They measure color based on an RGB color model. A large percentage of the visible spectrum (380 nm to 750 nm wavelength) can be created using these three colors. Limit switches are used here in order to keep exact base position. MCU (MICROCONTROLLER UNIT) is the central processing unit, which controls all the functions of other blocks in this system. MCU takes or read data from color sensor and controls all the functions of the whole system by manipulating these data.

MCU control the gripper motor on the robotic arm to pick an object, as per the signal from color sensor MCU can understand the color of the object, it control the arm motor to move towards the specified box, again control the gripper motor to release the object into that box.

MCU cannot drive a motor directly, so a motor interface is used here. The motor drive section accepts the low level logical signal from the controller and to provide necessary voltage and current excitation to the motor. Motor driver circuit is required to provide an interface between the 5V logic signal from the microcontroller & the high current / high voltage power side to drive the motor, because motor is an electromechanical device, which convert electrical energy to rotation/ mechanical energy. For this energy conversion large current excitation is required. These much energy cannot be provided by the logical signal pins from the microcontroller. So a motor interface is used here. The motor drive section should have the capability for accepting the low level logical signal from the controller and to provide necessary voltage and current excitation to the motor. Usually high current transistor switches or relays or ICs with motor drive packages are used for this purpose. Here bidirectional motor drive is required so an H-bridge based circuitry is used to control the arm motors and wheel motors.

Motor is used to drive the robotic vehicle. The motor should have torque and rpm to meet the requirement like move the vehicle by carrying battery and circuit load. DC motors are the best choice for this purpose. But DC motors

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are always comes with high rpm 2000 to 3000, and with lesser torque. So usually geared DC motors are used. Geared DC motors are well suitable because which have lesser rpm like 30 or 45 and have sufficient torque to drive the all mechanical load. A 12V motor is preferable because which can be easily connected to 12V battery. Hence we use geared dc motor for drive the robotic vehicle.

LCD display is used for displaying the status of the system. LCD module is a dot matrix liquid crystal display that displays alphanumeric, kana (Japanese character) and symbols. The built in controller and driver LSI, provide convectional connecting between LCD and most 4 or 8 bit microcontroller. The CMOS technology makes the device ideal for applications in handheld portable and other powered instruments with low power consumptions.

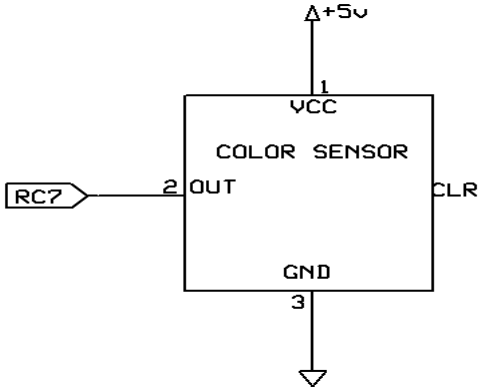
II. WORKING

Researches and experiments in the field of robotics are progressing tremendously. Robotic technology has influenced most of the industrial and domestic areas and has given release to the humans doing heavy, risky and tedious jobs. In many industries it is required to sort objects from a mixture of materials. This machine is a demonstrator of industrial object sorting robot based on color of object.

Here we have a robotic system which contains a robotic arm with a color sensor. A photodiode based color sensor is attached with the robot, after identifying the color of the picking object, the robot place the object in the respective box. DC GEARED motors are used here for the different actions and movements of the robotic arm. 6V DC motors are used here in both of its direction as per the requirement.

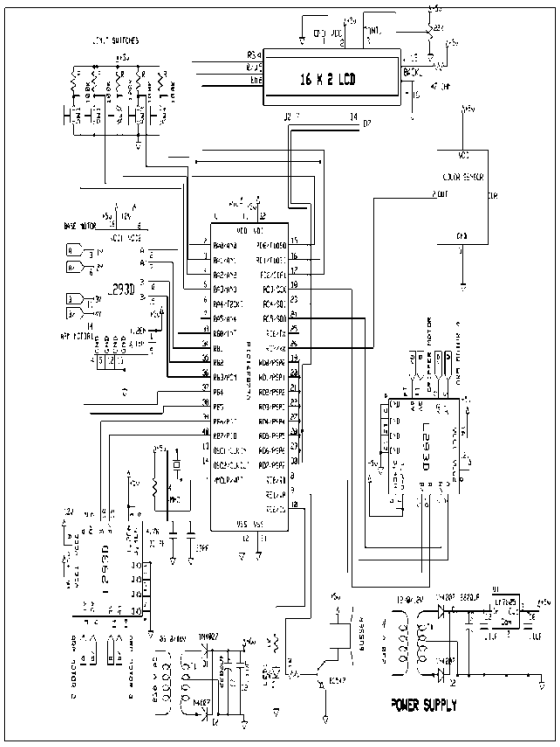
An arrangement to pick an item is attached with the arm and is also controlled by a DC motor. 6V power supply is used for the arm. Whole movements of all these motors are controlled in bi-direction by the MCU through IC hybrid bridge circuits. The system is used to pick an item from the conveyor belt and sorting it by color, it can be used in industrial and other purposes.

III. CIRCUIT DIAGRAM



IV. CIRCUIT DIAGRAM EXPLANATION

1. COLOR SENSOR



The color sensor identifies color and gives serial output of RBG value. It can identify 16.7 million color shades giving RGB value for the detected color. The detected color is identified as amount of three primary color values namely Red, Green & Blue with 8 bit accuracy for each primary color. Any color can be separated or combined into three primary colors Red, Green and Blue using the RBG values. The output of this color sensor is connected to RC7 of the MCU.

Features

- Individual RGB color detected.
- Simple 5V operation.
- Serial data output for complete
- RGB values
- UART interface for direct connection to any MCU or USB-TTL convertor.

Principle of Color Identification:-The sensor switches each primary color RGB, one by one and checks what intensity of color is reflected by the surface of detection. This reflected intensity is converted to 8 bit value. For example a RED surface will strongly reflect RED. While a YELLOW surface will reflect RED and GREEN both.

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According to the induction principle of the three primary colors which create various other colors in nature, once the value of three primary colors is confirmed, the color of the tested object is known. Knowing the value of RGB helps people gain the color of the light which is projected onto the sensor since each color correspond to only one value of RGB.

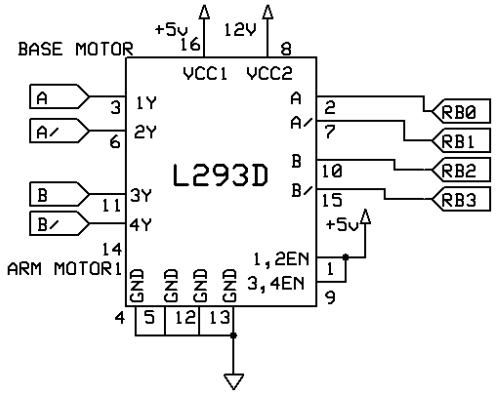
2. LIQUID CRYSTAL DISPLAY (HD 44780)

The HD 44780 is a liquid crystal dot matrix display Module that consists of LCD panel, LCD control driver, and driver and is capable of providing 16 characters x 2 lines display. It contains a controller, a data RAM and a character generator ROM required for providing display. Data interfacing is in 8-bit parallel or 4-bit parallel and data can be written in or read from a microprocessor.

Pin	Symbol	I/O	Description
1	GND	-	Ground
2	Vcc	-	+5V power supply
3	VEE	-	Contrast control
4	RS	I	command/data register selection
5	R/W	I	write/read selection
6	E	I/O	Enable
7-14	DB0-DB7	I/O	The 8-bit data bus

Pin Description of LCD Module

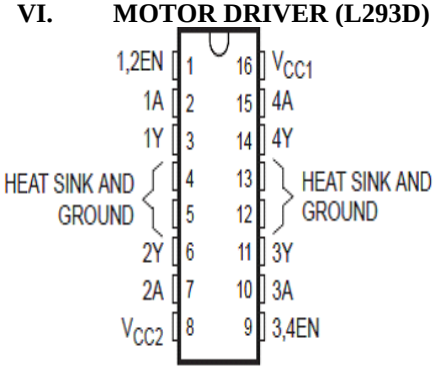
V. MOTOR CONTROL CIRCUIT



MCU cannot operate a dc motor directly. It operates the motor through the interfacing circuits. Here IC L293D acts as an interfacing unit between MCU and the DC motor.

One L293D can control two DC motors. So in order to drive five motors three L293Ds are used. In the circuit shown above the pins of IC L293D is connected to RB0, RB1, RB2 and RB3 of the MCU to drive the base motor arm motor 1respectively.

VI. MOTOR DRIVER (L293D)



The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo- Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input become high, the associated drivers will get enabled, and their outputs will become active.

These outputs are in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

The H-bridge (or "full bridge") is so named because it has four switching elements at the "corners" of the H and the motor forms the cross bar. The basic bridge is shown in the figure to the right. The key fact to note is that there are, in theory, four switching elements within the bridge. These four elements are often called, high side left, high side right, low side right, and low side left (when traversing in clockwise order).

The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge. If both switches on one side of a bridge are turned on it creates a short circuit between the battery plus and battery minus terminals. This phenomenon is called shoot through in the Switch-Mode Power Supply (SMPS) literature.

If the bridge is sufficiently powerful it will absorb that load and your batteries will simply drain quickly. Usually however the switches in question melt.

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To power the motor, you turn on two switches that are diagonally opposed. In the picture to the right, imagine that the high side left and low side right switches are turned on. The current flow is shown in green. The current flows and the motor begins to turn in a "positive" direction. If the polarity changed current flows the other direction through the motor and the motor turns in the opposite direction

VII. RESULTS AND DISCUSSION

This paper presents the design, development and construction of a robotic arm, which can pick and sort objects ofdifferent colour. The mechanical structure of the robot was assembled using aluminium brackets which helped toreduce the weight without losing the mechanical strength. The aim of the project was to have a fully functional roboticarm which sorts different coloured balls and the target is achieved successfully. In the final run of the project red,yellow and green balls were successfully sorted. The colour sensor IC TCS3200show almost stable response in various sunlight conditions. The system is working with open loop. A better resolution can be achieved if closed loop control is incorporated. Thesystem responses are a little bit slower than expected. It can be improved by using a more advanced colour sensor andmicrocontroller. User interfaces also can be provided as a modification which will enable the on demandreconfiguration of the movement in a better way.

REFERENCES

[1]. ShwetaPatil, Sanjay Lakshminarayan,"Position Control of Pick and Place Robotic Arm",EIE's 2nd Intl' Conf.Comp., Energy, Net., Roboticsand Telecom. EIE Con2012.
[2]. A. Rama Krishna, G. SowmyaBala, A.S.C.S. Sastry, B. BhanuPrakashSarma, GokulSaiAlla," Design And Implementation Of A Robotic ArmBased On Haptic Technology", International Journal of Engineering Research and Applications. Vol. 2, Issue 3, pp.3098-3103, May-Jun 2012.
[3]. Ahmed M. A, Haidar1, Chellali, Benachaiba2, Mohamad, Zahir, " Software Interfacing of Servo Motor with Microcontroller", Journal of Electrical Systems, 9-1, pp 84-99, 2013.
[4]. h t t p : / / e n . wi k i b o o k s . o r g / wi k i / Embedded_System
[5]. Swain, M., and Ballard, D. Color indexing. International Journal of Com- puter Vision (Jan 1991).
[6]. Schiele, B., and Crowley, J. L. Recognition without correspondence using multidimensional receptive field histograms. International Journal of Computern Vision 36 (2000), 31–50.
[7]. Schneiderman, H., and Kanade, T. A statistical method for 3d object detection applied to faces and cars. IEEE Computer Society Conference on Computer Vision and Pattern Recognition 1 (2000), 1746.
[8]. Agarwal, S., Awan, A., and Roth, D. Learning to detect objects in images via a sparse, part-based representation. IEEE Transactions on Pattern Analysis and Machine Intelligence 26, 11 (Nov 2004), 1475 – 1490.