Color Detection & Segregation using ARM7 Processor

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ABSTRACT

Color detection and segregation is a useful, costless and fastest system in pharmetiucal applications to reduce human mistake when manual system is undertaken. The objective of this project is to design an efficient, microcontroller based system that can detect right color of objects and put it down at right place to optimize the productivity, minimizing the cost of the products and decreasing human mistakes. The controller used is an ARM 7 having high speed performance, low cost and 32Kbytes program memory. It communicates with color sensor TCS3200 and various motor modules in real time to detect the right color. Also, the use of easily available components reduces the manufacturing and maintenance costs. The design is quite flexible as the software can be changed according to specific requirements of the user. This makes the proposed system to be an economical, portable and a low maintenance solution for industrial applications.

Keyword: - *Color Sorting, Motors, Color Sensor.*

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1. INTRODUCTION

The importance of automation in 21st century is increasing day by day to reduce human mistakes in their daily tasks because of their ability to do much difficult tasks;

The proposed system is an embedded system which will increase the speed of color sorting procedure, provide the accurate color sorting process, decrease the cost of color sorting process and can place right capsule in right object. The system comprises of color sensor, stepper and microcontroller. Color sensor detects the specified color of the object and microcontroller reads this from the data at its input ports. The microcontroller conveys its decision to the station that been programmed. Since a microcontroller is used as a heart of the system, it makes the set up low cost and effective nevertheless. The significance of a project can be estimated from its current utilization and future prospects of advancements.

2. LITERATURE SYRVEY

Vindhya D. et al. [1] has proposed "Design and Development of Object Recognition and Sorting Robot for Material Handling in Packaging and Logistic Industries". In this proposal a MATLAB code is written for the algorithm for performing the operation. The algorithm is executed to identify the object and send the appropriate commands to the microcontroller using serial communication for the robot to perform the sorting operation.

Reeves [2] presented, with a demand for increased productivity from robotic manipulators, multiple robot arms are being used for applications which are more time consuming, difficult or impossible for a single arm. Because of increased computational complexity, a single processor is opening inadequate to meet real-time demands. We present a pick-arid-place operation for two robot arms, controlled and synchronized by a multiprocessor real-time operating system.

3. METHODOLOGY

Color detection and segregation is a system having a capability to select the specified color object and place it at a desired location. Firstly, when object color is determined by the color sensor, the solenoid valve will allow or

permit the flow of object until color is detected and displayed. The station consists of a color sensor named Light Dependent Resistor (LDR) which detects the light reflected by the body. TCS 3200 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 color sensor.

There is an 8*8 matrix of photodiodes in the sensor i.e. 64 filter sensors are used in it. All these filters are collect RGB (red, green, blue) data from the source [3] [4]. The data collected from the sensor is converted into a square wave of 50% duty cycle by an oscillator integrated in the chip. This wave is then sent directly to the microcontroller.

Microcontroller transfers signal to the motor drivers to activate the solenoid valve to allow or permit the flow of object and drop it to the place defined by programming of controller.

4. DESIGN AND WORKING

Fig-1: Block Diagram.

4.1 MAIN CONTROL UNIT (MCU)

The main unit contains ARM 7 processor, stepper motor and some other components. To provide 5 volts, LM7805 (regulator) is used in the power supply circuit board.

4.2 COLOR SENSING BOARD

This unit consists of a Microcontroller (PIC18F452), Color Sensor TCS 3200, a Push Button (named GO Button) and some other components. When GO Button is pressed, microcontroller will enable the color sensor to detect the color of placed object on it. Color Sensor TCS 3200 will detect the intensity of Red, Green and Blue in color of the placed object and send it to microcontroller for further process. PCB design of color sensor.

The microcontroller will compare intensity values of red, green and blue to detect the color of placed object. If intensity value of red is greater than green and blue then object's color is red. If intensity value of green is greater than red and blue then object's color is green. If intensity value of blue is greater than green and red then objects color is blue [10]. After detecting color of the object, the microcontroller will give signal from low to high of time interval of 500ms and then, low its pin of corresponding color.

5. HARDWARE DESCRIPTION

Different components were used in this project. List of the components used in this project are:

5.1 STEPPER MOTORS

A brushless, synchronous motor that exchanges digital pulses into mechanical rotation of shaft is called stepper motor. The stepper motor's revolution is divided into a discrete number of steps, almost 200 steps in each revolution and sent a separate pulse for each step. At a time one step can be taken by stepper motor and each step includes the same size. Since each pulse of the step causes the motor to rotate at an angle of 1.8°, the position of the motor can be controlled without any providing feedback mechanism as shown in figure 2. As the frequency of the digital pulses increases, the movement of the steps also increases causing continuous rotation with the speed of rotation proportional to the frequency of pulses. Due to their low price, high potential torque at low speeds, high reliability and a simple, rugged construction, Stepper motors are used daily in both industrial and commercial applications.
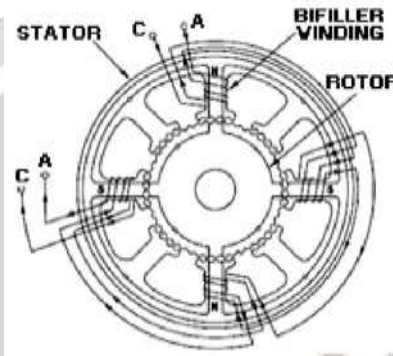
Fig-2: Stepper Motor

5.2 ARM7 PROCESSOR

Designed by British company ARM holdings who usually design family of computer processors that use RISC architectures. Are reduced instructions set computer (RISC) architectures. Require significantly less number of transistors then traditional computer. Low power consumption. High accuracy analogue to digital conversions (ADC).Program memory is 32 K bytes and data EEPROM memory is 256 bytes.

5.3 COLOR SENSOR

The Color sensor is a programmable light-to-frequency converter, it can filter RGB (Red, Green, and Blue) data obtained from source light and convert it to a square wave form having 50% duty cycle with frequency proportional to light intensity. The full-scale output frequency can be measured by one of available three preset values with the help of two control input pins SO, S1 and pins S2, S3 are used to control the RGB filter. Digital inputs and digital outputs allow interfacing with a microcontroller directly. So color of the object's light is calculated by RGB values. The schematic diagram of color sensor is shown in figure 3.

TCS 3200 color sensor is chosen for this project due to conversion of light intensity into frequency, programmable color ability and giving full-scale output frequency, direct communication with a PIC microcontroller, power supply can be 2.7 V to 5.5 V, minimum error capability [5].

Fig-3: TCS 3200.

Stem has been successfully designed and it has the capability to detect and segregate color successfully and handle the required task. It can take specific colored object, hold it and put it to a particular station even to some height using RGB color sensor. Color sensing section performed two main tasks; object's detection and color recognition. The cost effective system was designed to perform the continuous and reliable tasks without human errors using the simplest concepts. The color detection systems are useful in pharmaceutical industries and different household activities. Since this system is mainly controlled by the ARM 7 processor, the results obtained are more reliable and faster.

5.4 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LEDS. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animation and so on.

6. CONCLUSION

This project is designed so the color sorting system is used to perform the sorting of objects with the help of color sensor. The system can be advanced by increasing the efficiency of color sensor which is the key component of the project used for distinguishing the objects. Selecting the right material for selection of right color sensor to accurately distinguish between different colors. Another area of improvement in this project is a design for using Digital Image Processing (DIP). The ultrasonic imaging, remote sensing, astronomy, medicine, automated industry inspection and space exploration. Image processing can be done by using some image classification algorithms using different spectral features, the brightness, and color information presented in each pixel.

7. ACKNOWLEDGEMENT

8. REFERENCES

[1] Vindhya Devalla, Dr. Rajesh Singh, Amit Kumar Mondal and Vivek Kaundal, "Design and Development of Object Recognition and Sorting Robot for Material Handling in Packaging and Logistic Industries," International Journal of Science and Advanced Technology , Volume 2. No. 9 September 2012.

[2] L.A. Reeves and M. Farooq, "A Multiprocessor Pick-and-Place Operation for TWO Robot Arms," Dept. of Electrical and Computer Engineering, Royal Military College of Canada, Kingston, Ontario, 0-7803-1443-3, Proceedings of 1993 IEEE.

[3] M.H. Liyanage, N. Krouglicof, R. Gosine, "Design and control of a high Performance SCARA type robotic arm with rotary hydraulic actuators," Canadian Conference on Electrical and Computer Engineering (CCECE), 2009, pp. 827-832.

[4] M. H. Liyanage, N. Krouglicof, R. Gosine, "High speed electro-hydraulic Actuator for a scara type robotic arm," International Conference on Intelligent Robots and Systems (IROS), 2010, pp. 470-476.

[5] http://www.stepperworld.com/Tutorials/pgUnipolarTutorial.html

[6] Mike J. Johnson and Guru Subramanian, "A Parallel Port Interface Circuit for Computer Control Applications Involving Multiple Stepper Motors," University of Northern Iowa, IEEE, Circuits and Systems, Vol 2, pp. 889-892, 1997.

[7] Kapil Shivatare, Prashant Jadhav, Amit Shelke, "Three way controlled Robotic Arm," Siddhant College of Engineering Sudumbare (May 2011), India.

[8] Yeow Khang Yung, "Color Sorting System with TCS3200," Faculty of Electronic and Computer Engineering University Technical Malaysia Melaka, (2011).

[9] Alexander Getman, Jinhak Kim, Tae-Chan Kim, "Imaging system having White-RGB color filter array," in Proceedings of 2010 IEEE 17th International Conference on Image Processing September 26-29, 2010, Hong Kong.

[10] M. C. Mulder, S. R. Malladi, "A minimum effort control application for Cooperating sensor driven intelligent multi-jointed robotic arm," Proceedings of the 30th IEEE Conference on Decision and Control, vol. 2, pp. 1573-1578, 1991.

[11] E. Oyama, T. Maeda, J.Q. Gan, E.M. Rosales, K.F. MacDorman, S. Tachi, A. Agah, "Inverse kinematics learning for robotic arms with fewer degrees of freedom by modular neural network systems," International Conference on Intelligent Robots and Systems (IROS), 2005, pp. 1791-1798.

[12] Malvin Nkomo, Member of SAIEE and Michael Collier, "A Color-Sorting SCARA Robotic Arm," College of Information and Electrical Engineering Shandong University of Science and Technology Qingdao, (2010), China.