

# ATmega328 Skittle Sorter

Deepak Sharma<sup>1</sup> Balvant Khara<sup>2</sup>

<sup>1,2</sup>B.E Student

<sup>1,2</sup>Department of Electrical Engineering

<sup>1,2</sup>SAL institute of Tech. & Eng. Research, Ahmadabad, India

**Abstract**— Now a day to design a sorting system based on color for industries is very difficult. Industries are using image processing technology to detect various colors. Sometimes it is not possible to use image processing forms small company and for the small application. Instead of that using color frequency for sorting color skittles or candy with help of ATmega328.

**Key words:** Arduino atmega328, Color sensor TCS 3200, RGB Sensor chip, Servo motor

## I. INTRODUCTION

This machine sort candy or color skittles based on color. Each and every color has own wavelength value. Typically human eyes respond to wavelength from 390nm to 700nm. Like green color has 495nm to 570nm wavelength and yellow color has 570nm to 590nm. This machine embedded with color sensor TCS3200 .this color sensor is cheapest color sensor its sense the color frequency. And display output on screen TCS3200 sense color light with the help of 8\*8 array of photodiode. Then using current to frequency converter output signal in square wave. The frequency directly preoperational to light intensity with the help of atmega328 it can read the output in square wave .ATmega328 is identified color frequency and it is also programmable with servo motor .servo motor consume power and rotate in angular form .servo motors and color sensor both programs binding with each other when in programming each color wavelength has fix angle .if 570nm-590nm color frequency was identified it mean it is yellow color skittle and it has fix angle in programming is 30 degree then servo motor rotate 30 degree. Same as in other skittles color frequency was identified bt sensor and its output visible on screen

## II. BLOCK DIAGRAM

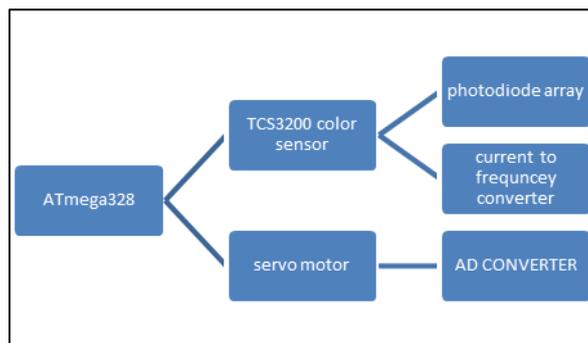


Fig.1: block diagram of ATmega328 skittle sorter [1]

Machine centroid is ATmega328 and other component TCS3200 and servomotor connected with machine.TCS3200 color sensor is working on RGB color model and sense color frequency wavelength TCS3200 8pins and it is programmable light to frequency converter that combine configurable silicon photodiode and current to frequency converter on single monolithic cmos .current to frequency converter is electronic circuit and it is produce output in square wave this wave consider as reference input signal in atmega 328.



Fig. 2: working model of ATmega328 skittle sorter [2]

With help of pulse width modulation ATmega328 read this square wave ATmega328 is programmable controller this is easily read or write analog input-output and also digital input- output .servo motor has binding programming with TCS3200 same time it sense reference input and reflect effect on both equipment .two servo motor used in this machine with one servo motor rotate in angular form and another one push skittle into path. This full process output result visible on

computer screen. This machine sorting different color based on their frequency .ATmega328 used low power and TCS3200 also used low power that time its need to use A to D converter .this is convert ac volt into 5 volt power supply .

### III. ATMEGA328

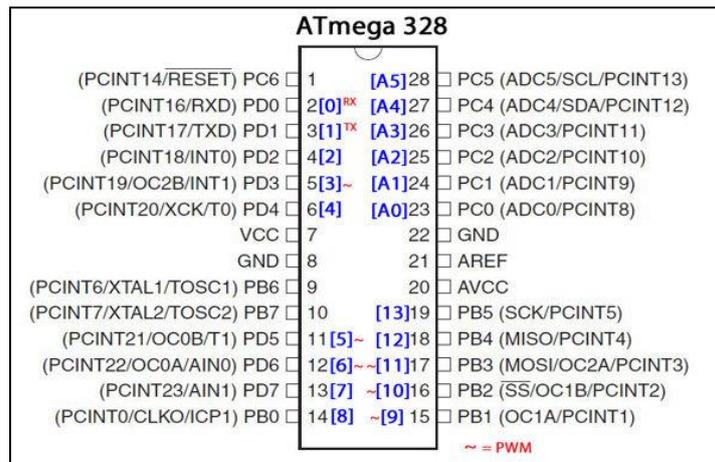


Fig. 3: pin diagram of Atmega328 [3]

The Atmega328 has rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit, allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The ATmega328 provides features 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter, three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs, 1 byte-10-bit ADC, a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator and the asynchronous timer continue to run

### IV. TCS3200 COLOR SENSOR

The TCS230 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color. The photodiodes have three different color filters. Sixteen of them have red filters, another 16 have green filters, another 16 have blue filters and the other 16 photodiodes are clear with no filters.



Fig. 4: TCS3200 color sensor [4]

Each 16 photodiodes are connected in parallel, so using the two control pins S2 and S3 we can select which of them will be read. So for example, if we want to detect red color, we can just use the 16 red filtered photodiodes by setting the two pins to low logic level according to the table. In TCS3200 total 8 pins are placed.

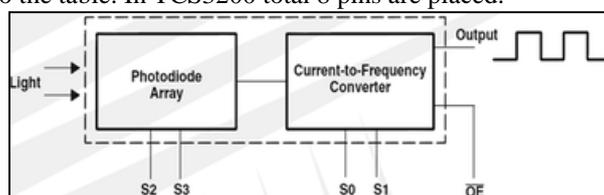


Fig. 5: working principle of TCS3200 color sensor [5]

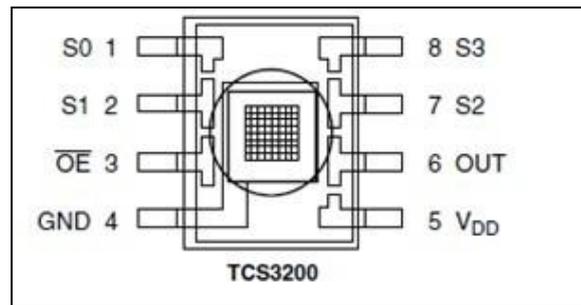


Fig. 6: pin diagram of TCS3200 color sensor [6]

- S0,S1-scaling output frequency.
- S2,S3-photodiode selection input.
- VDD- Voltage supply
- OE- enable for f0(active low)
- GND- all voltage reference to ground.

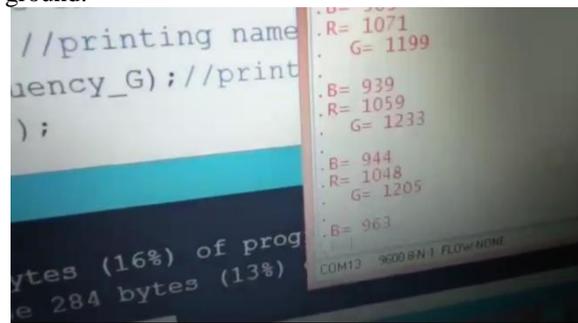


Fig. 7: color sensor output in software screen [7]

## V. SERVO MOTOR

DC servomotors are one of the main components of automatic systems; any automatic system should have an actuator module that makes the system to actually perform its function. The most common actuator used to perform this task is the DC servomotor. Historically, DC servomotors also played a vital role in the development of the computer's disk drive system; which make them one of the most important components in our life that we cannot live without it. Due to their importance, the design of controllers for these systems has been an interesting area for researchers from all over the world. However, even with all of their useful applications and usage, servomotor systems still suffer from several non-linear behaviors and parameters affecting their performance, which may lead for the motor to require more complex controlling schemes, or having higher energy consumption and faulty functions in some cases. For these purposes the controller design of DC servomotor system is an interesting area that still offers multiple topics for research, especially after the discovery of Artificial Neural Networks and their possible usage for intelligent control purposes.

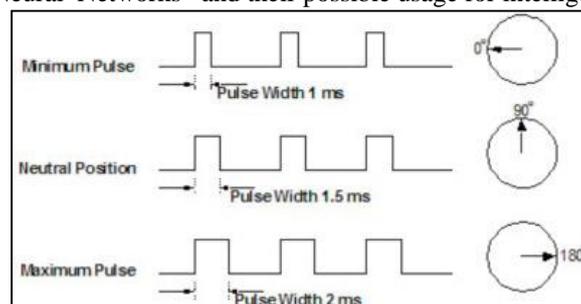


Fig. 8: Working Principle of Servo Motor [8]

## REFERENCES

- [1] <https://blog.arduino.cc/2016/07/20/this-arduino-machine-will-sort-your-skittles-by-color/>
- [2] <http://www.instructables.com/id/MM-Color-Sorter/>
- [3] <https://github.com/chen-yumin/skittle-color-sorter>
- [4] <http://www.charmysoft.com/app/skittle-sorter>
- [5] <http://www.freetronics.com.au/blogs/news/14773945-the-arduino-powered-skittles-and-m-ms-sorting-machine>
- [6] <http://hackaday.com/2013/12/21/quick-candy-sorting-machine/>
- [7] <https://www.cnet.com/news/3d-printed-machine-sorts-skittles-by-colour/>

- [8] <https://www.engineersgarage.com/mygarage/skittles-mms-sorting-machine>
- [9] <http://www.reviewmylife.co.uk/blog/2014/12/22/high-speed-mandm-sorting-machine/>
- [10] <http://howtomechatronics.com/tutorials/arduino/arduino-color-sensing-tutorial-tcs230-tcs3200-color-sensor/>
- [11] <https://3dprint.com/94687/fully-automatic-3d-printed-skittles-sorter/>
- [12] <https://in.pinterest.com/pin/310889180500426229/>
- [13] Hinduri Publishing Corporation modeling and Simulation in Engineering Volume 2007, Article ID 50586, 6 pages  
doi:10.1155/2007/50568.