A

PROJECT BASED REPORT

On

COLOR SORTING MACHINE USING MY RIO AND IMAGE PROCESSING

By

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1.ABSTRACT

For sorting object in industry optical sorting is very much convenient. Color and size are the most important features for accurate classification and sorting of product which can be done by using some optical sensors or analyzing their pictures. The color sorting machine is mainly a device that can sense the different color of the object and assert them into different belt conveyor. When object moves from one place to another with the rotation of conveyor belt, sensors as the input devices will send signal to microcontroller where microcontroller as the controller will give command to the actuator to do action. The final result was quite satisfactory. The color detecting sensors worked well and it was able to detect red or green object quite nicely and change the direction of servo on right and left side to sort the object in proper place. The belt moved from starting point to the end point through the roller without conflicting with the walls. The system performed well as programmed and detects the object according to their color.

CHAPTER ONE

INTRODUCTION:

Nowadays, in the present state of intense competition, production efficiency is generally regarded as the key of success. Production efficiency includes the speed at which production equipment and production line can be lowering material and labor cost of the product, improving quality and lowering rejects, minimizing downtime of production equipment and low cost production equipment. Taking this matter under consideration the project is developed which is very useful for industries.

Main objectives of the study are studying various sorting processes, designing and fabrication of conveyor belt, designing and fabrication of automatic color sorting system of product on conveyer belt, automatic rejection of defective product from conveyer belt.

The main advantages of the system are less time required to sort the product, as the whole system is performed by machine there is less possibility of mistake, less man power required. If the industry can produce the product within the required range then the demand of the product will be increased. So the company will be benefited.

1.1 Background

The new age of technology has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. But the application of mobile phone cannot just be restricted to sending EMAIL or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra- red, Bluetooth, etc. which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. Sound, heat, obstacle, detection and touch sensing security system is a subject of growing interest and in recent years we have seen many systems providing such security systems these days, apart from supporting voice calls a mobile phone can be used to send text messages as well as multimedia messages (that may contain pictures, graphics, animations, etc.). Sending written text messages is very popular among mobile phone users. Instant messaging, as it is also known, allows quick transmission of short messages that allow an individual to share ideas, opinions and other

relevant information. We have used the very concept to design a system that acts a platform to receive messages which in fact are commands sent to control different appliances and devices connected to the platform. We have designed a security system which is based on the LABVIEW technology that effectively allows control of different security systems concerned with different factors. The application of our suggested system is immense in the ever changing technological world. It allows a greater degree of freedom to an individual whether it is controlling the household appliances or office equipment. The need to be physically present in order to control appliances of a certain location is eliminated with the use of our system.

1.2 Motivation

As an engineering students a project is required to change theoretical idea to visible form work. The project chosen is home security system via mobile technology. This technology is selected because of incorporating mobile technology with the detection of home security system which can be believed as the next important steps to realize the home security. The comfort of being able to detect home security has become imperative as it controls risky factors and during emergency situation. Because of jobs make people busy and far away from their home the need to control the safety of their remotely from intrusion. To satisfy these needs the project enable the people to control their home at distance somewhere from their home at the time of emergency situation like motion and obstacle detection.

1.3 Statement of problems

Technology has advanced so much in the last decade or two that it has made life more efficient and comfortable. The comfort of being able to detect color and sort according to it is to design color sorting machine using LABVIEW technology. As this project become imperative as it saves a lot of time and effort. Therefore there arises a need to do so in a systematic manner in which the proposed idea have tried to implement with the system. The proposed system is an extended approach to color sorting machine.

With the advancement and breakthroughs in technology over the years, the lives of people

have become more complicated and thus they have become busier than before. With the adoption of the system, the aim of controlling over certain things that required constant attention. In the life experience of people the following problems may be raised.
These are:

1. Sorting of Bad objects from good objects
2. Predicting of an object quality Based on color and shape of object

The problems cited above can be solved on the basis of color sorting machine using LABVIEW technology. The proposed approach for designing this system is to implement a LABView module that receives its instructions and command from a cellular phone over the LABVIEW network. MyRio will carry out the issued commands and then communicate with sensors and back to the VI.

1.4 Objectives and Goals

The aim of the project is to develop and launch on up to date, reliable and user friendly color sorting system to automate LABVIEW module with an objective to provide maximum possible prediction of quality of an object based on color and shape of an object.

1.5. Scope of the Project

The system specification shows the description of the function and the performance of system and the user. The scope of the project LABVIEW Based color sorting machine is immense.The future implications of the project are very great considering the amount of time and resources it saves. The project itself can be modified to achieve a complete knowing of object quality based on color and size of an object in industries.

Chapter Two

Literature Review

1. **Design and construction of color sensor based optical sorting machine by** Timothy Henry ; Laurence ; Ishak ; Ferry Jie
2. **Lego bricks color sorting machine by** Sazly Anuar ; Allya Badzura Baharuddin ; Amirah Mohammad
3. **Real-time color-based sorting robotic arm system** by Yonghui Jia ; Guojun Yang ; Jafar Saniie

2.1 Design and construction of color sensor based optical sorting machine

Quality plays significant role to stay competitive in the market, especially in industries that many new products enter and leave themarket. The basic requirement is to ensure that only products meet the quality standards can be released, and this is possible by implementing high-quality inspection to sort the products. However, manual sorting of bulk items is very difficult due to a large number of inspected items. Thus, automatic optical color sorting machine could be an answer to solve the problem. The aim of the study is to design and construct a color sensor based optical sorting machine and was carried out through several stages; problem identification, research purpose formulation, literature review, machine requirements determination, machine and software design, machine construction, commissioning, machine capability testing, and conclusion. Some capabilities of final assembled and programmed machine were tested, from color identification, ejection, and sorting. The experiments show that the machine is capable of correctly detecting 74.75% of good materials, without false detection of the bad materials, while on the other hand the machine successfully ejecting 94.02% of the materials marked to be ejected. The sorting capability of this machine reached recovery efficiency of 67.41%, and defect removal efficiency of 85.07%.

2.2 Lego bricks color sorting machine:

LEGO Bricks Color Sorting Machine is a system with capability to sort LEGO bricks

according to their color. This system design uses Arduino Mega as a controller. In this project, PIXY sensor is used to detect the color of the object after it was manually fed by users at feeding slide. Based on the sensor readings, the system will automatically start to sort them to their exact location or station. The top splitter slot will move to the left or right in order to adjust the location for the drop. The advantage of this system is the capability of the system to sort LEGO bricks based on its color, and contains a station for rejected object if it does not meet the system requirements, for example color is not detected or object is not recognized. The system helps to sort the object in fastest time and without any errors. The experimental results support the goals which is to develop the LOGO bricks color sorting machine with reduced sorting time and better quality in the field of automation.

2.3 Real time color sorting robotic arm system :

Sorting is a labor intense process. With machines that can recognize objects, it is possible to automate the sorting process. In this paper, we present a robotic sorting arm based on color recognition technique. In this system, when a new frame is captured by the camera, the object will be detected using color-base image processing technique. The position of the object in real-world will be calculated by its mass center in image. Using Inverse Kinematics algorithms, the control input for the robotic arm will be calculated and then sent to Arduino microcontroller. Then, the microcontroller will drive the motors on the robotic arm to sort and position the objects according to their color. Using the proposed technique, the sorting robotic arm system can distinguish and sort different objects successfully with properly tuned parameters for both machine vision and 3D mobility of the robotic arm

2.4 LABVIEW TECHNOLOGY

LABVIEW is a global system for mobile communication is an international digital cellular telecommunication. The LABVIEW standard was released by ETSI (European telecom standard institute) back in 1989. The first commercial services were launched in 1991 and after its early introduction in Europe; the standard went global in 1992. Since then, LABVIEW has become the most widely adopted and fastest-growing digital cellular standard, and it is positioned to become the world’s dominant cellular standard. Today’s

second-generation LABVIEW networks deliver high quality and secure mobile voice and data services (such as EMAIL Text Messaging) with full roaming capabilities across the world. LABVIEW platform is a hugely successful technology and as unprecedented story of global achievement is less than ten years since the first LABVIEW network was commercially launched, it become, the world's leading and fastest growing mobile standard, and spanning over 173 countries. Today, LABVIEW technology is in use by more than one in ten of the world's population and growth continues to sour with the number of subscriber worldwide expected to surpass one billion by through end of 2003.

Today's LABVIEW platform is living, growing and evolving and already offers an expanded and feature-rich 'family' of voice and enabling services. The Global System for Mobile Communication (LABVIEW) network is a cellular telecommunication network with a versatile architecture complying with the ETSI LABVIEW 900/LABVIEW 1800 standard. Siemen's implementation is the digital cellular mobile communication system D900/1800/1900 that uses the very latest technology to meet every requirement of the standard.

LabVIEW can execute inherently in parallel.1–2 Multi-processing and multi-threading hardware is exploited automatically by the built-in scheduler, which multiplexes multiple OS threads over the nodes ready for execution.

Chapter Three

Methodology & Implementation

3.1 Component Description

Servo Motor:

A **servo motor** is a closed-loop system that uses position feedback to control its motion and final position. In industrial type **servo motors** the position feedback sensor is usually a high precision encoder, while in the smaller RC or hobby **servos** the position sensor is usually a simple potentiometer. **Servo motor works** on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically, **servo motor** is made up of DC **motor** which is controlled by a variable resistor (potentiometer) and some gears

Fig(4) Servo Motor

AC to DC LED Drivers:

AC-DC LED Drivers. We offer our clients a broad range of **AC-DC LED Drivers**, used as a solution in portable electronics. Our range provides constant current over a range of input voltage. These are designed with self-contained **power supply** and widely appreciated for its high efficiency and easy operation.

Fig(5) Motor Driver

Regulated DC Supply :

A **regulated power supply** is an embedded circuit; it converts unregulated AC (Alternating Current)into a constant DC. With the help of a rectifier it converts AC supply into DC. Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits. The output from the regulated power supply may be alternating or unidirectional but is nearly always DC The type of stabilization used may be restricted to ensuring that the output remains within certain limits under various load conditions, or it may also include compensation for variations in its own supply source. The latter is much more common today.

Fig(6) Dc Power Supply

Web Camera:

A **webcam** is a video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks travelling through systems such as the internet, and e-mailed as an attachment. When sent to a remote location, the video

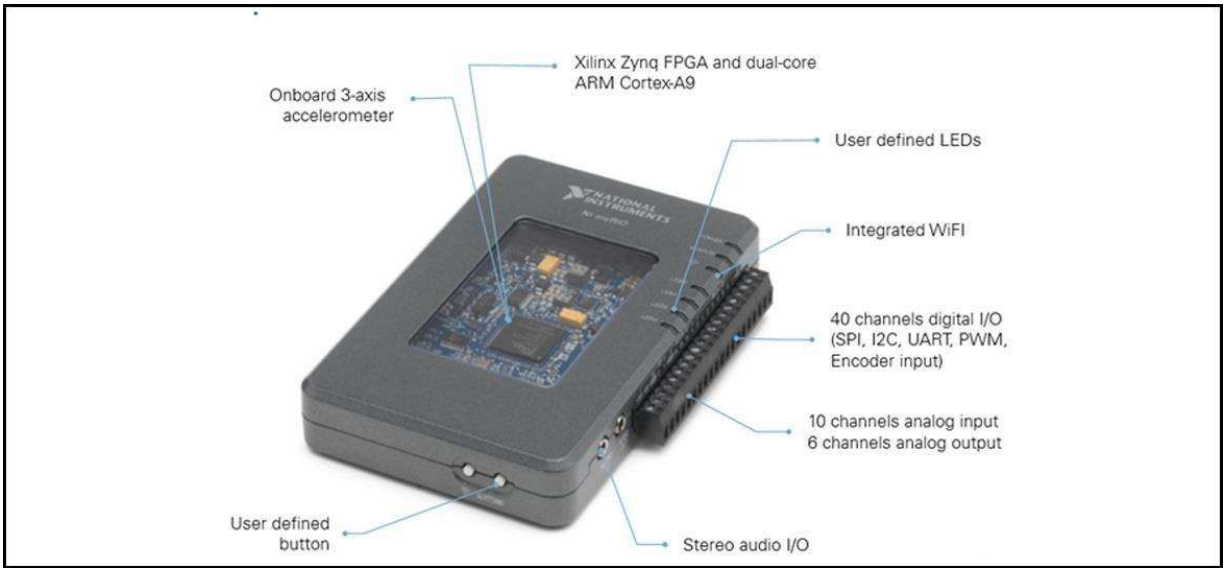
stream may be saved, viewed or on sent there. Unlike an IP camera(which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

Here the it is used for Color Recognition Purpose

Fig(7) Web Camera

My Rio:

The myRIO Student Embedded Device features I/O on both sides of the device in the form of MXP and MSP connectors. It includes analog inputs, analog outputs, digital I/O lines, LEDs, a push button, an onboard accelerometer, a Xilinx FPGA, and a dual-core ARM Cortex-A9 processor. Some models also include Wi-Fi support. You can program the myRIO Student Embedded Device with LabVIEW or C. With its onboard devices, seamless software experience, and library of courseware and tutorials, the myRIO Student Embedded Device provides an affordable tool for students and educators.



Fig(10) My Rio

3.2 Pin description of Rio

Pin Diagram:

DIO15 / I2C.SDA	34	33	+3.3 V
DIO14 / I2C.SCL	32	31	DIO10 / PWM2
DGND	30	29	DIO9 / PWM1
DGND	28	27	DIO8 / PWM0
DIO13	26	25	DIO7 / SPI.MOSI
DGND	24	23	DIO6 / SPI.MISO
DIO12 / ENC.B	22	21	DIO5 / SPI.CLK
DGND	20	19	DIO4
DIO11 / ENC.A	18	17	DIO3
DGND	16	15	DIO2
UART.TX	14	13	DIO1
DGND	12	11	DIO0
UART.RX	10	9	AI3
DGND	8	7	AI2
AGND	6	5	AI1
AO1	4	3	AI0
AO0	2	1	+5V

Fig (12)Pin Diagram

Digital I/O (DIO) and Counters/Timers

There are eight, software-timed DIO lines on the NI myDAQ that can be individually configured for input or output. Additionally, lines DIO can be configured for counter/timer functionality. The input—accessed through DIO 0, DIO 1, and DIO 2 signals configured as a counter—is used for counter, timer, pulse width measuring, and quadrature encoding applications. When using the counter/timer, the Source is accessed through DIO 0, the Gate through DIO 1, the Auxiliary Input through DIO 2, the Output through DIO 3, and the Frequency Output through DIO 4. When using the counter/timer as a quadrature encoder, A, Z, and B correspond to DIO 0, DIO 1, and DIO 2, respectively. In some instances, the software may refer to the output lines as PFI as opposed to DIO.

My Rio:

Analog Output Channels:

The NI myRIO-1900 has analog output channels on myRIO Expansion Port (MXP) connectors A and B, Mini System Port (MSP) connector C, and a stereo audio output connector. Each analog output channel has a dedicated digital-to-analog converter (DAC), so they can all update simultaneously. The DACs for the analog output channels are controlled by two serial communication buses from the FPGA. MXP connectors A and B share one bus, and MSP connector C and the audio outputs share a second bus. Therefore, the maximum update rate is specified as an aggregate figure in the Analog Output section of the Specifications. MXP connectors A and B have two analog output channels per connector, AO0 and AO1, which you can use to generate 0-5 V signals. MSP connector C has two analog output channels, AO0 and AO1, which you can use to generate signals up to ±10 V. The audio outputs are left and right stereo line-level outputs capable of driving headphones.

Accelerometer

The NI myRIO-1900 contains a three-axis accelerometer. The accelerometer samples each axis continuously and updates a readable register with the result.

DIO Lines

The NI myRIO-1900 has 3.3 V general-purpose DIO lines on the MXP and MSP connectors. MXP connectors A and B have 16 DIO lines per connector. On the MXP connectors, each DIO line from 0 to 13 has a 40 kΩ pullup resistor to 3.3 V, and DIO lines 14 and 15 have 2.1 kΩ pullup resistors to 3.3 V. MSP connector C has eight DIO lines. Each MSP DIO line has a 40 kΩ pulldown resistor to ground. DGND is the reference for all the DIO lines. You can program all the lines individually as inputs or outputs. Secondary digital functions include Serial Peripheral pulse-width modulation (PWM), and quadrature encoder input. Refer to the NI myRIO software documentation for information about configuring the DIO lines.

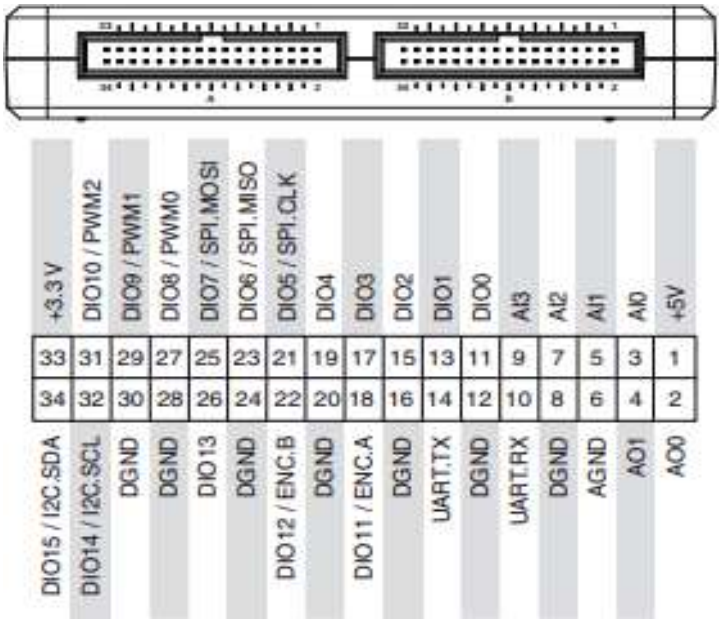


Fig (13) Pin Configuration of MyRio

3.3 Vi Implementation

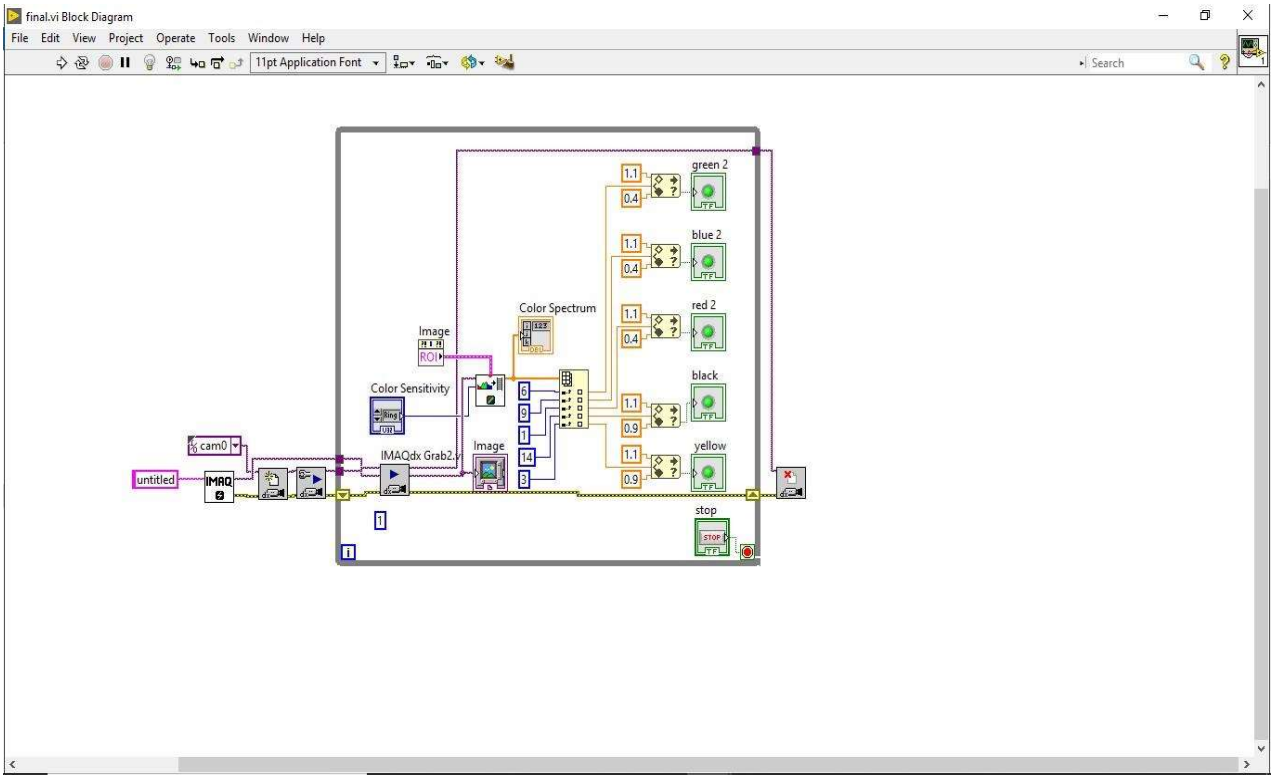


Fig (15) COLOR SENSING VI

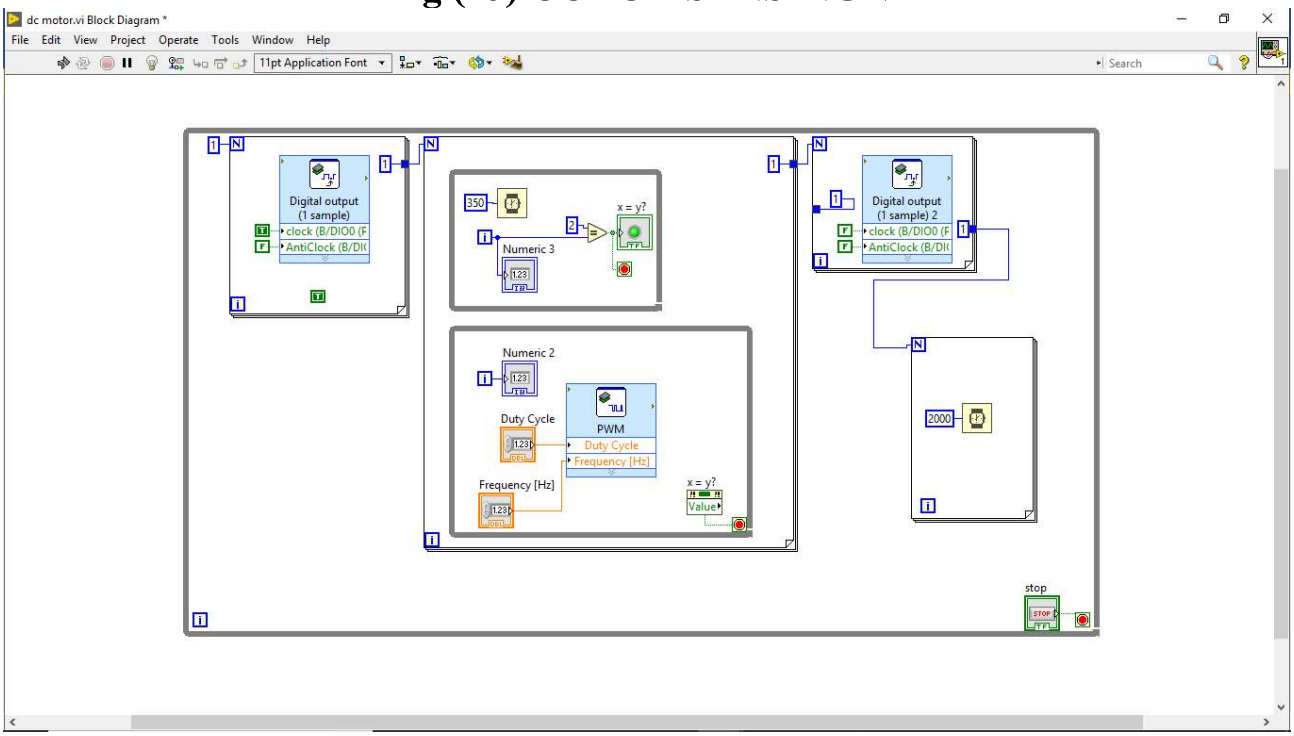
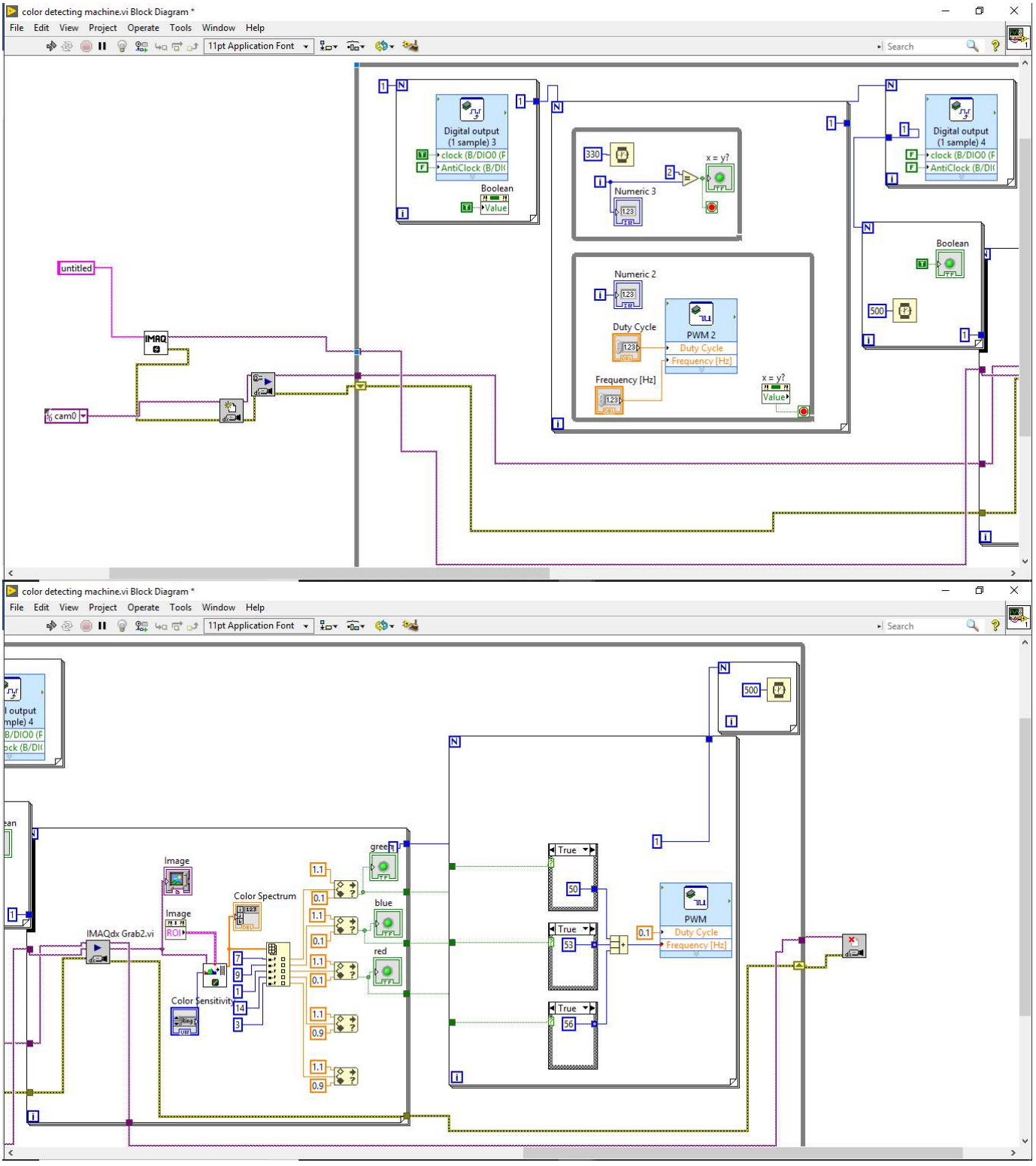


Fig (16) DC MOTOR VI (CONVEYOR BELT)

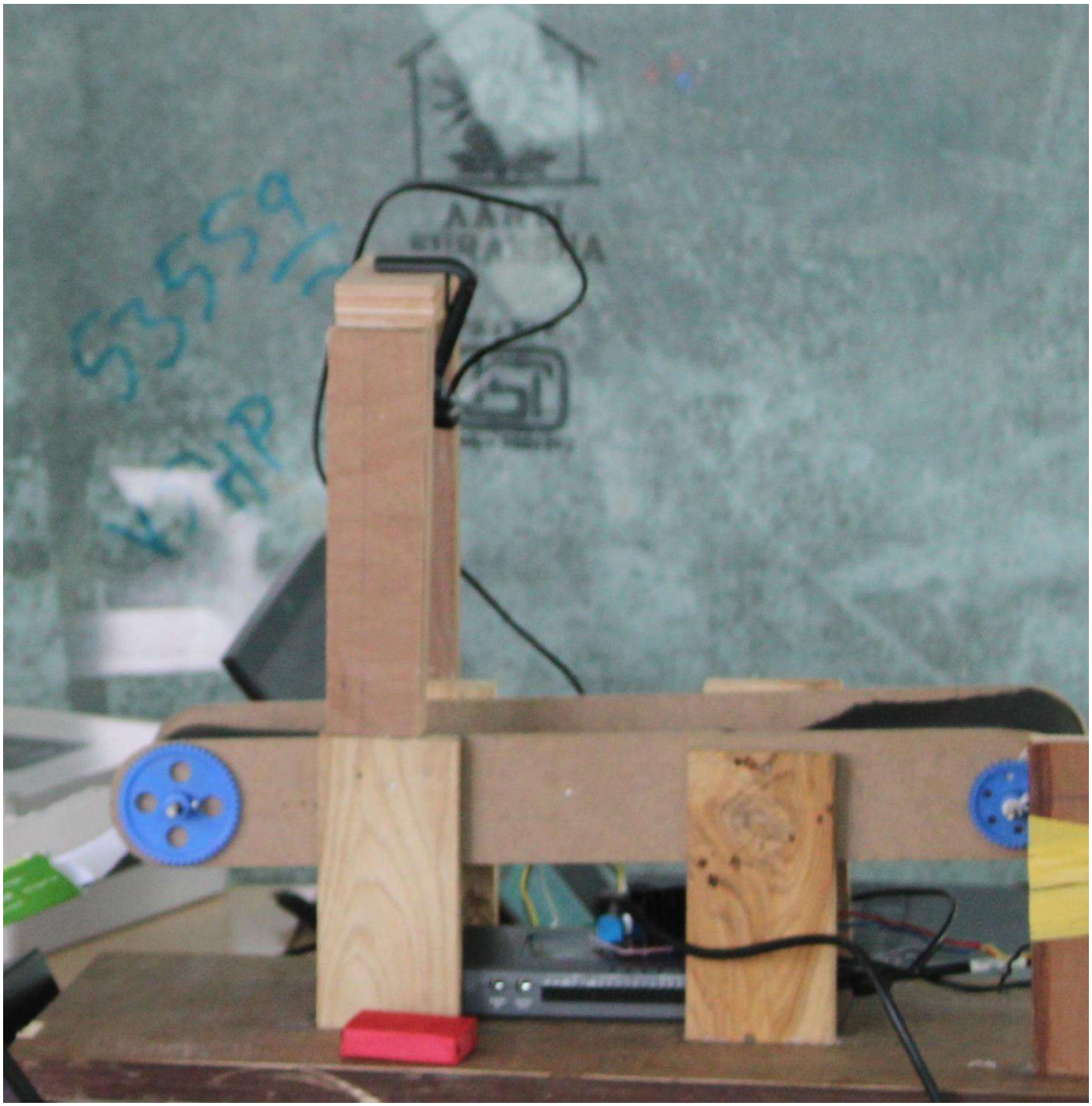


Fig(17)MAIN VI (COMBINGING ALL VI'S)

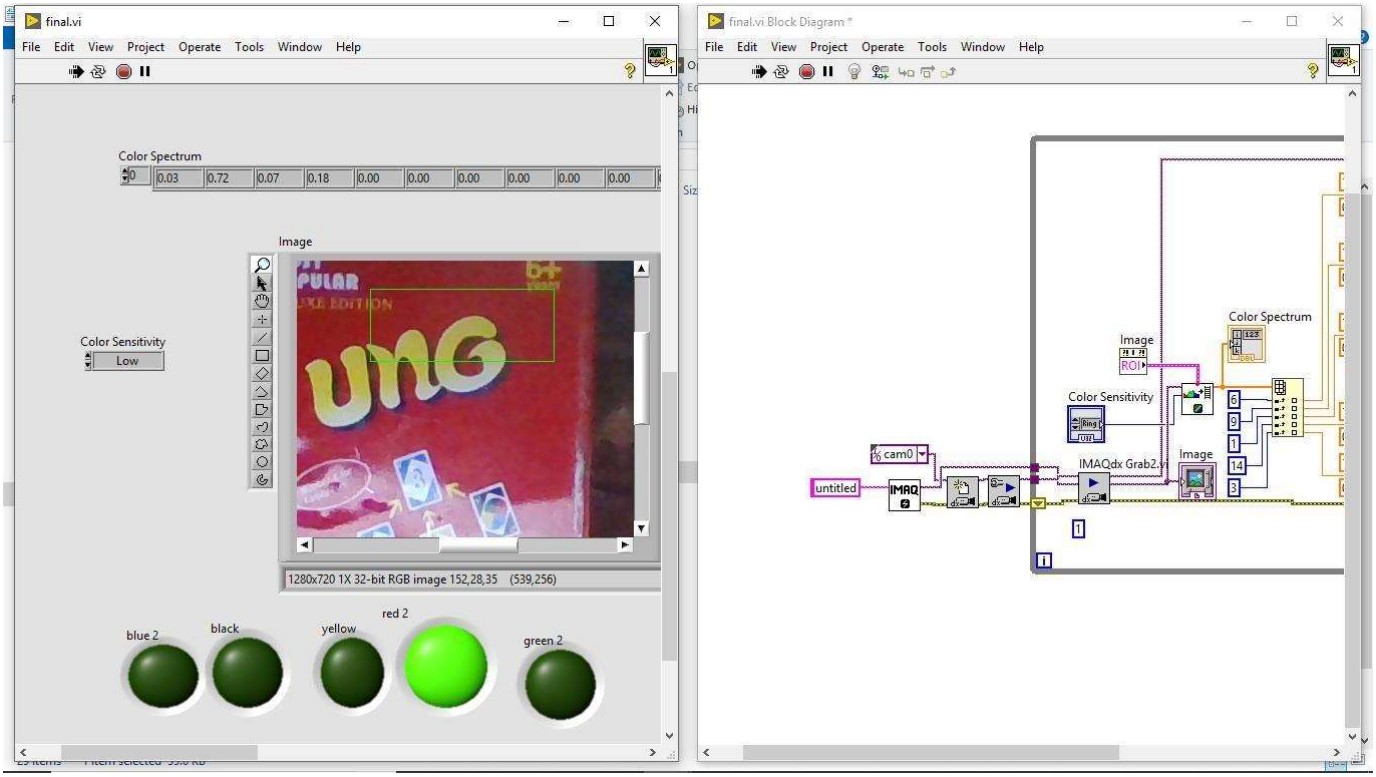
3.3.1 Circuit Analysis and Approach

- Our model consists of total of 3 processes
    1. Conveyor Belt (Dc motor)
    2. Colour Detecting VI
    3. Servo Motor to sort things
- Dc motor is attached to the Conveyor Belt and using LABVIEW VI we control the movement of the conveyor belt.
- VI is designed in such a way that the DC motor rotates for 1 sec and stops for 1 sec
- The object is placed on starting of the conveyor belt and after rotating for 1 sec. The object stops below the camera
- Then camera captures the image of the object. Then using color Detecting VI the color of the object is determined.
- Then using the servo motor. We sort the objects According to their respective colors
- Servo motor is controlled using Labview in such a way that for particular range of valves(obtained from colour detecting VI) in rotates to a particular Direction

3.5 Hardware Implementation



Fig(20).Complete View


final.vi
File Edit View Project Operate Tools Window Help
Color Spectrum
0.03 0.72 0.07 0.18 0.00 0.00 0.00 0.00 0.00 0.00
Image
Color Sensitivity
Low
1280x720 1X 32-bit RGB image 152,28,35 (539,256)
blue 2
black
yellow
red 2
green 2
final.vi Block Diagram *
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Color Spectrum
Image
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Color Sensitivity
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Image
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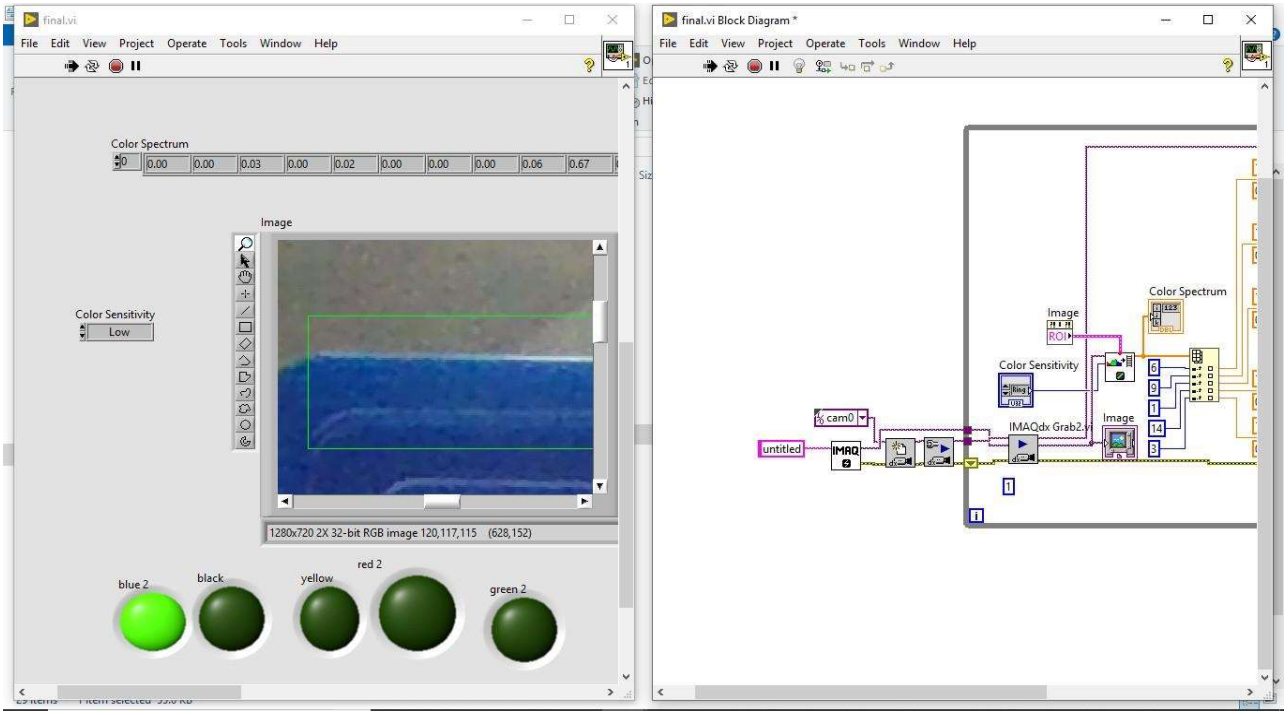
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Color Spectrum
0.00 0.00 0.03 0.00 0.02 0.00 0.00 0.00 0.06 0.67
Image
Color Sensitivity
Low
1280x720 2X 32-bit RGB image 120,117,115 (628,152)
blue 2
black
yellow
red 2
green 2
final.vi Block Diagram *
File Edit View Project Operate Tools Window Help
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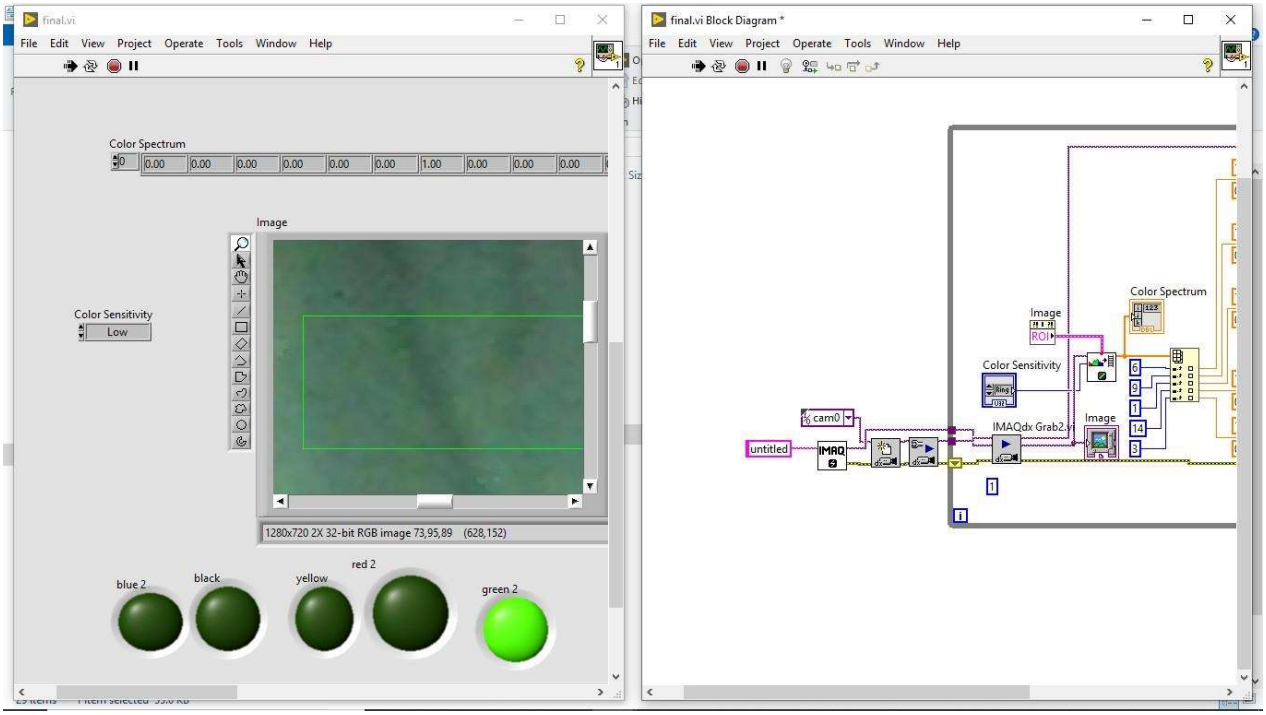

3.6 Advantages of the proposed system

- Quality – Color Sorter machines have revolutionised quality in Food products. Manufacturers can easily monitor the quality of the products and easily launch those in the market.
- Control – Manufacturers can easily decide and change the extent of color and texture difference to reject. This gives them an added control over the products, for example sorting the item into multiple categories.
- Speed – Color Sorter machine is automated and doesn't retard the quality check speed. In-fact it speeds-up the overall quality assurance process by removing human effects such as fatigue and strike.

  Return on Investment (ROI) – Color Sorter machines have an excellent ROI as they are near to one-time investment and require low maintenance.
- Labour – Automated machines reduce labour cost and management issues. Also it shortens the accepted error margin to a large extent which mainly comprises human errors.

3.7 Problem Faced

Along the course of project completion, we encountered various problems and obstacles. Not everything that we had planned went smoothly during the project development span. Also we had a limited amount of time for its completion so we were under a certain amount of pressure as well. We had to start from the research phase at the beginning and needed to gain knowledge on all the devices and components that we had intended to use for our project. Other phases of the project included coding, debugging, testing, documentation and implementation and it needed certain time for completion, so we really had to manage the limited time available to us and work accordingly to finish the project within the schedule.

3.8 Limitations

- The project has certain limitations and a list of such is mentioned below;
- The model is dependent on the light where in high light conditions the model gives the desired results
- But in low light conditions it some times failed to give the desired results.

3.9 Future Scope

1. We can sense multiple color by color sensor and sorted more objects using extra hardware assembly.
2. We can use a Robotic arm to pick and place the object.
3. By using counter we can count the number of objects.

CHAPTER FOUR

Conclusion and Recommendation

4.3 Conclusions:

In this we have made an hardware using national instruments tool using my rio and using image processing . With the help of image processing we detected the colour of the object on the conveyor belt and we separated and sorted the different colour objects according to their colors.

4.4 Recommendation

We have recommended the following points for the proper implementation and future development of our project:

- Connect MyRIO using Wi-Fi rather than connecting it directly to your system. That makes controlling easier
- For cost cutting use colour sensors in place of colour sensing using image processing
- Web camera is applicable to take the photograph of every object and count the no of Objects sorted

CHAPTER FIVE

References

1. **Design and construction of color sensor based optical sorting machine by** Timothy Henry ; Laurence ; Ishak ; Ferry Jie
2. **Lego bricks color sorting machine by** Sazly Anuar ; Allya Badzura Baharuddin ; Amirah Mohammad
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