OBJECT GRADING USING EMBEDDED SYSTEM

Dissertation submitted in partial fulfillment of the requirements for the

Degree Of

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IN

ELECTRONICS AND COMMUNICATION ENGINEERING

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DECLARATION BY THE SCHOLAR

I hereby declare that the work reported in the B-Tech project entitled **"Object grading using Embedded system"** submitted at **Jaypee University of Information Technology, Waknaghat India,** is an authentic record of my work carried out under the supervision of **Mr. Munish Sood** I have not submitted this work elsewhere for any other degree or diploma.

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CERTIFICATE

This is to certify that the work reported in the B.Tech project report entitled **"Object sorting using embedded system"** which is being submitted by **Ruchika Ranaut(141084), Apoorva Sahu(141092), Deavershi tiwari(141041)** in fulfillment for the award of Bachelor of Technology in Electronics and Communication Engineering by the Jaypee University of Information Technology, is the record of candidate's own work carried out by him/her under my supervision. This work is original and has not been submitted partially or fully anywhere else for any other degree or diploma.

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ABSTRACT

In today's industries the demand for automation is rapidly increasing. Sorting of an object on the basis of its color is quite a difficult task. This report gives us some idea about sorting of object based on their color. In here we are outlining and executing an efficient color sorting robot using the color sensors TCS3200 based on Arduino UNO. This project will give a high accuracy and performance rate. It reduces the human errors as it is easy to form and operate. As the continuous manual sorting creates some issues therefore sorting of products in industries is strenuous. Hence creating a machine that can recognize those objects and relocate them in case that object meets a predefined criteria is very desirable. This report gives some idea of sorting the objects with different colors with the help of a linear actuator. In this project the colored objects that are being sent on the conveyor belt are relocated to a specific location with the help of the color, IR and UV sensors. As the object changes its location on the conveyor belt the sensors will sense it and send the input to the microcontroller which will then give the command to the actuator and it'll push the object in the specific location. The TCS3200 colour sensor is being used for the detection of color and DC motors are used for the movement of the conveyor belt. Arduino Uno microcontroller is being used to give out the commands. L293D motor driver is used to drive the motors and LCD display makes the system user friendly.

Key words: Arduino UNO controller, TCS3200 color sensor, servo motors. Color sorting, Conveyor belt, DC motor, LCD display, L293D motor driver, Microcontroller, Robotic arm, TCS3200 colour sensor.

CHAPTER -1

INTRODUCTION

Now a days industry wants high accuracy and performance in their products. Color is one of the best parameter on which we can sort different objects at industry level. This report gives us an idea about how the color sorting robot works and reduces human efforts. These color sorters can be used in agriculture field to sort grains, rice, fruits etc. These also can be used in different industrial applications like in plastic industries to sort toys, to sort various colored nuts and bolt. On further development this project is effective as it increases the speed of production, lowers the manual and the labor cost, improves the quality and decreases the rejection chances so taking everything into consideration the project developed is quite useful in industries. The point of undertaking this project is to acquire a system that is fully automatic at material handling. This is finished with the assistance of a microcontroller unit. This unit synchronizes the movement of the linear actuator to throw the object from the conveyor belt to a specific area. This prompts in accomplishing accuracy and speed of the production and also elimination of the tedious work done by the human. The project includes color sensors that can sense the color of the object and sends signal back to the microcontroller based on which that is the which type of color is detected the linear actuator comes into play by and moves the object throwing off the conveyor belt to the preprogrammed location reserved for the that particular color. As the articles are being arranged, at the same time the counting of the object by further programming should likewise be possible.

In the speed running world you know everybody is considers time as a vital factor. So to manage the time or to decrease it we have done a small execution from our project that is be useful to the large or small scale industries.In this intense competition world the growth of the project or the scope of it is decided by the speed of the production, the labor cost, the quality, lowering material cost and reducing the rejection rate. And to obtain that as discussed above the main work lies with the microcontroller that is Arduino uno in this case and other devices like the conveyor belt, the actuators, the color sensors, the relays, the dc motors, the IR sensors etc. complementing it or working in accordance with the command given to them by programming and linking them with the microcontroller. To sense the different color of

the object the color sorting machine is used in the process. With the rotation of conveyer belt the object moves from one place to another, sensors as the input devices will send signal to microcontroller where microcontroller as the controller will give instructions to the actuator to do work or action. The final result is pretty good as the color sensors worked just fine as they were able to identify the red and green objects by pushing them in their decided location or sort the objects in their proper place, with the help of the actuator that works on the basis of changing the direction of the servo motor in right and left side

The main advantages of the system is that less time is required to sort the product, as the whole system is performed by the machine so there is less possibility of errors and less man power required. If the product produced by the industry within the required range then the demand of the product will be increased and the industries would be benefitted.

CHAPTER -2
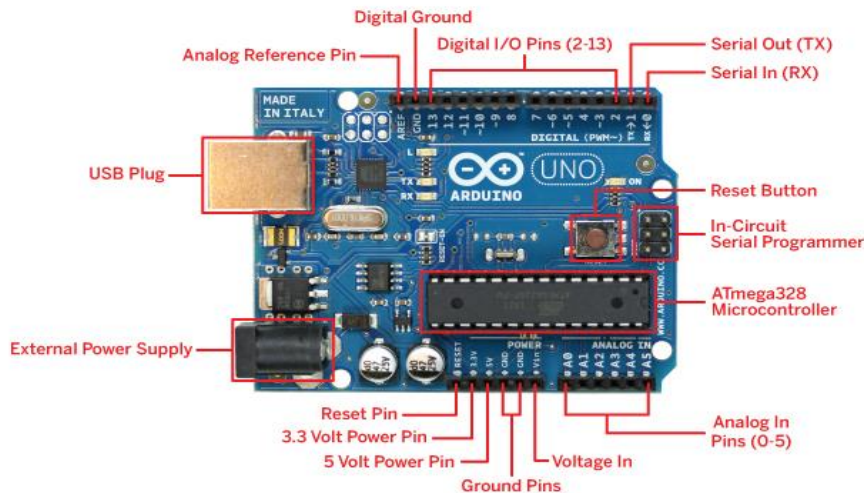# COMPONENTS USED

2.1 Arduino uno:

Figure 1: Arduino

Arduino is the microcontroller based open source electronic prototyping board which can be modified with an Arduino IDE the Arduino comprises of both a physical programmable circuit board and software.

The Arduino IDE utilizes a rearranged rendition of c++ making it simple to learn.

Arduino is a brand name and its Arduino uno display is simply the most broadly appropriated gadget the equipment itself is an open source outline this means anybody can uninhibitedly duplicate the plan or can outline their own particular board and offer their own clone or subsidiary item, accordingly Arduino is nothing one of a kind yet is the blend of equipment plan, the product plan and the group around it. Arduino is somewhat of a fast prototyping apparatus. The straightforwardness of the Arduino dialect makes it simple for nearly everybody who has an enthusiasm for hardware to compose programs without the comprehension of complex calculations or codes. Arduino is an astounding planned open source stage. It has boards that are specially designed which can be customized utilizing the Ardunio Programming Language (APL). We can program it so we can get certain activities performed. Additionally we can interface sensors like distance of light, temperature sensors

and furthermore gadgets like LEDs, servo engines and so on to the Arduino stage to perform physical activities. The Arduino consists of the following components:

About the equipment the gadget can be controlled by the usb port or the dc control jack ,

The usb connector is a printer usb port used to stack a program from the Arduino IDE onto the board. The usb port likewise completes a serial programming and communication from the PC.

The power port of the Arduino board can be controlled through an ac to dc adaptor or a battery the power source can be associated by connecting to a 2.1 mm centre positive plug into the power jack of the board. The Arduino board works at 5V yet can withstand a most extreme of 20V.

On the off chance that the board is provided with higher voltage there is a voltage regulator that shields the board from burning.

Arduino uno an Atmel AVR based microcontrollers and the uno contains two microcontrollers the one which is smaller in size is on the left performs out the usb to serial conversion and at the right side contains the heart of the microcontroller a 18 mega 328 microcontroller which resembles a little PC which we can program to do diverse things. It is the most conspicuously noticeable dark rectangular chip with 28 pins. This microcontroller utilized is called Atmega328P by Atmel facilitate the Atmega 328P has the accompanying parts in it:

•   Flash memory of 32kb. The program stacked from the Arduino IDE is put away here.
•   RAM of 2kb. It is the runtime memory.
•   CPU : Everything that goes on within the device is controlled by it. It brings the program guidelines from flash memory and runs it with the assistance of RAM.
•   Electrically Erasable Programmable Read Only Memory of 1kb.

Atmega328P is pre-customized with bootloader. This enables us to specifically transfer another Arduino program into the gadget, without utilizing any outside hardware programmer making it simple to utilize.

A set of input and output pins is available on the other side called the digital I/o pins named as "digital 0 to 13" every one of which can be programmed as either the input or the output

and they are digital in the way that they can be on or off or can be high or low. When utilized as output , these pins go about as the source of power supply for the parts connected with it and when utilized as input pins they read signals from the components associated with them.
 A couple of these digital I/o pins are uncommon they are called PWM and are demonstrated with a little wavy line beside the pin number (pin numbers 3, 5, 6, 9, 10, and 11) what that implies is that they can go about acting as an analog output by sending pulses like for an example, dim an LED while the other pins will only turn it on or off at full brightness. The for the power connections we can take 3.3 or 5v from them for our components and a ground line.

6 analog inputs are labeled as "Analog 0 to 5" they work only as inputs and can be connected to devices like microphones, a variable resistor or a light sensor generally anything that can give us a range of outputs. The signal can be read from the analog sensors like the temperature sensors and for the system understanding it is converted into a digital value. The pins do not measure the current but only the voltage because of their high internal resistance because of which a very small amount of current flows throughout these pins. These pins can also be used for both the digital input and output as well.

Reset switch : when the reset switch is flicked, a logical pulse will be sent to microcontroller reset pin and runs the program again from the scratch. It is very useful in case we want to run the code multiple times and the code does not repeats.

Crystal oscillator: a quartz crystal oscillator that in a second ticks 16 million times and an operation is performed by the microcontroller on every tick say of addition, subtraction etc.

Usb interface chip: it acts as a signal translator that can converts the signals at a level that an Arduino can understand from the usb level.
TX RX indicator: TX stands for transmitting and RX for receiving which are the indicator LEDs that blinks when the board is receiving or transmitting data.

Now the layout of the pin is standardized which means we can buy upgrades of additional functionality called shields say an additional Ethernet and sd card shield which will give you network access and additional storage space and prototype it on an original Arduino board.

Then there's also very small debug LED build within the Arduino at pin 13 which can be used to test the program quickly.

Software

The hardware of the Arduino has a microcontroller IC that in order to perform a specific task needs to be programmed. Which can be written using the Arduino Programming Language in the Arduino software and after the program is compiled it is then loaded onto the memory of the Arduino board using either a serial or a USB connection.

In order to program the Arduino uses Arduino integrated development environment or IDE , this program is not actually installed instead we just have to download the Arduino folder and put it wherever you want and run it from there and if we want to add a new piece if hardware like a motion sensor and want to include its libraries to help with the code just put them in the library folder. An IDE is a text editor like program that allows us to write computer code that will be uploaded to the Arduino board. Whenever we save a file in Arduino software it is called a sketch, a place where all the computer codes that you have written are saved and its dot extension is .ino or previously as .pde . a code editor is included that can perform tasks like searching and then replacing of texts, cutting and pasting of texts ,brace matching, automatic indenting and highlighting the syntax not only this it provides a one click simple mechanism that organize and upload the programs to the Arduino board.

The Arduino IDE has languages such as C++ and C that it bears with the help of special rules of code structuring. Only two basic functions are required for a user-written code one for starting the sketch and one for the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program.

- **setup**()**:** at the very start of the program this function is run once to begin settings.
- **loop**()**:** until the board is switched off or is reset , this functional is repeatedly executed.
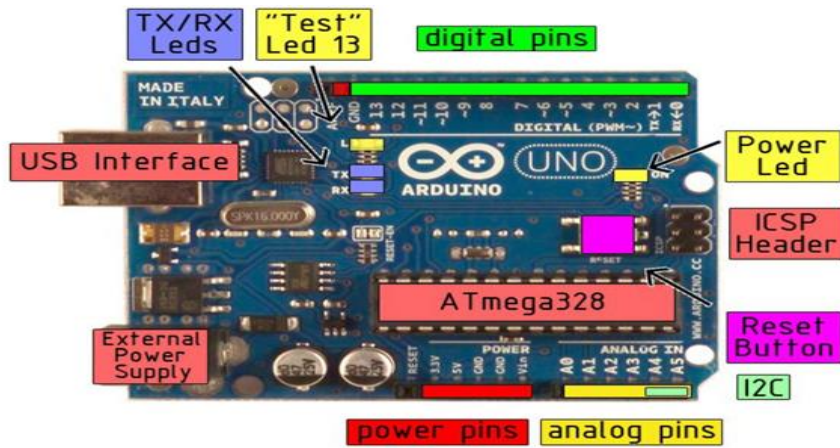
Figure: 2

2.2 RELAYS:

Figure: 2

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They connect the low power digital devices with the high power devices. I allows digital microcontrollers and circuits to switch on and off the high power devices. The relays are frequently used in interfacing the electronic circuit, that is working at a lower voltage, to an electrical circuit that works on a higher. For an instance, a relay be used to switch a 230V AC main circuit from a 5V DC battery circuit.

A relay works as an electromagnetic switch which is utilized in applications of turning the circuits or devices on and off by operating at a low power signal or in the cases where a number of circuits are to be controlled by one signal.

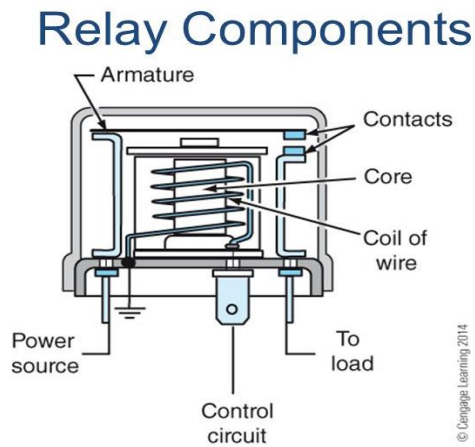Main parts of a relay is shown in the below figure:

Figure: 3

Relay works the same way as a switch . So its concept is same.

NO or Normally open contact – also called make contact. The circuit is connected when the relay is activated and vice versa.

NC or Normally closed contact – also called as a break contact. It's the opposite of NC, as the circuit disconnects when the relay is deactivated and vice versa.

Change over(CO)/Double throw (DT) contacts- this type is used to control both the NO and NC contact by using a common terminal. They are accordingly called break before make and make before make contacts.

By using one signal we can use the relays to control several circuits. There are various kind of relays such as-
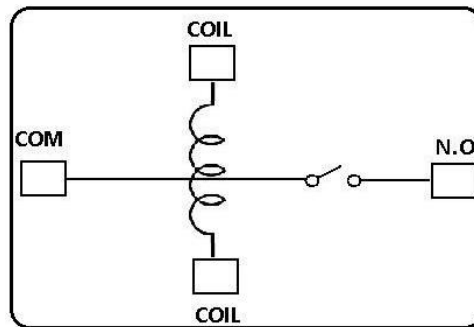
- **Single pole single throw or SPST**

Figure: 4
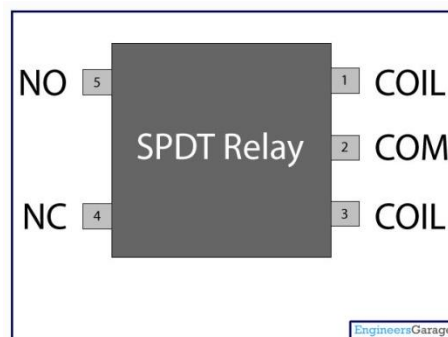
- **Single pole double throw or SPDT.**

Figure: 5

- **Double pole single throw or DPST**
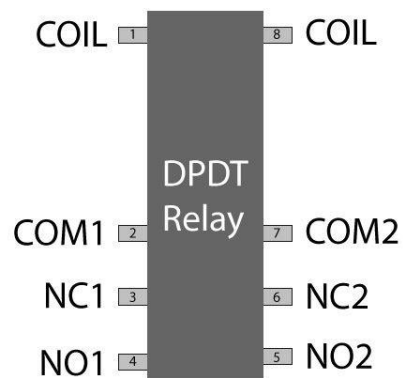
- **Double pole double throw or DPDT**

Figure: 6

- Relays are utilized wherever it is important to control a high voltage or a high power with a low power circuit.

- The very first or the primary use of relays was in the long telegraph lines, where the received weak signal could control a contact at an intermediate station, and can recover and regenerate that signal for the further transmission.

- The small and low voltage wiring and pilot switches can control the high current and voltage devices. The operators could be isolated from the circuits that are of high voltage. Low power gadgets, for example, microprocessors can drive the relays in order to control the electrical loads past their immediate drive ability.

- In case of automobiles, the starter relay permits the high current of the cranking engine to be controlled by little wiring and contact at the ignition point.

Electromagnetic relays are still commonly used in applications because they are simple, cheap and most importantly provide complete physical isolation between control and load circuit so in the applications where the circuit needs to be on or off with a very little on state voltage drop, or to avoid any danger of damage or any injuries from the leakage current the electronic relay is hands off a better alternative.

How does the relay functions?

The below circuit consists of a relay that has a coil from which when a current passes, builds up a magnetic so what happens is that if you run a small power through this magnetic coil which is inside the relay it actually generates a small magnetic field which will magnetically pull a switch into a closed position to allow the current to flow from the other side. Here we have two different circuits with a relay between them and both are electrically isolated. So by switching on one circuit on the low power circuit side and we'll see that the switch on the other side of the circuit is magnetically pulled which will then allow the ac circuit to run the lamp.
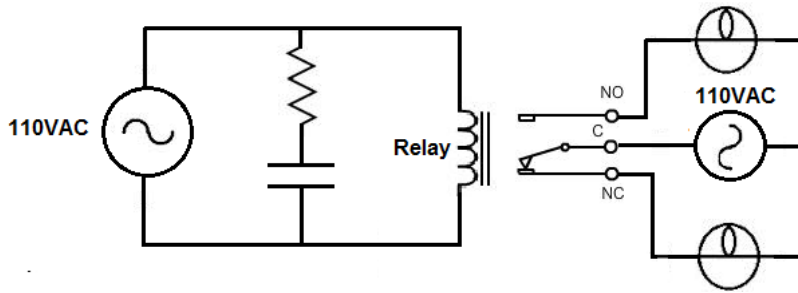
Figure: 7

The relays are so significant as they allow digital device processes in computers which run at a very low power to control high powered electronic devices such as motors and many others basically allowing the computers and the microcontrollers to interface with these much larger devices. Now in this project we use Arduino which is a low power device which runs off 5v, we used it to run a bit of code that interfaced with the computer which would then activate the relay.

2.3 Toggle

Figure: 8

A toggle switch has two different positions. Switching from one setting to the other is called toggling. This is a kind of switch which on getting performs one activity and when pressed again performs different activity.

The best example is the Caps lock button in the keyboard.

Toggle in the project is used to turn on and off the power supply.

2.4 LED :

Figure: 9

Light emitting diodes (**LEDs**) two lead semiconductor sources they are p-n junction diode that emit light when activated once proper voltage is applied to the lead, electrons are able to recombine electron holes within the device which releases energy in the form of protons this effect is known as electro luminescence and the color of the resulting light is determined by the energy band gap of the semiconductor. All diodes release light however most do not do it effectively because the semiconductor material in a normal diode typically absorbs a lot of the light produced LEDs are specially constructed to release a large number of photons outward. The plastic bulb in which they are housed in also concentrates the light in a particular direction typically bouncing of the side of the walls and then travelling around through the rounded end. The light emitted from **LED**s varies in between the visible to the infrared and uv regions. They are common electronic components and are used as indicators in the circuits and are also use for luminance and other optoelectronic purposes.

The two terminals of LED are anode or the positive terminal which is the longer leg and cathode or the negative terminal being the shorter leg.

The forward voltage of the **LEDs** that is between 1.7 to 2.2v is less than the supplied voltage i.e. 5v and using it as this would burn it as the high current will destroy the pn gate that's why a current limiting resistor is used in series. Without this there will either be a low input voltage or pulse width modulation is used to implement LED.
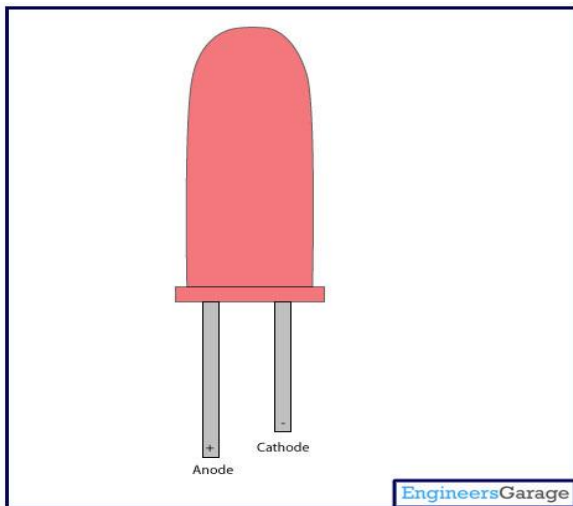
Figure: 10

2.5 COLOR SENSOR :

Figure: 11

The color sensor which is based on TCS3200, basic constituents of the sensor are the header interface, then the mounting holes, 4 white LEDs, the sensor cover and the sensor itself. This kind of sensors are a programmable color light to frequency convertors that combine configurable silicon photodiodes and a current to frequency convertor on a single monolithic CMOS integrated circuit so the output is a square wave with a 50% duty cycle representing the frequency is directly proportional to the intensity of the light or say the color irradiance. The working principle of this is that it senses the color light with the help of an 8x8 array of photodiodes then using a color to frequency convertor the readings from the photodiodes are converted into a square wave with the frequency proportional to the light intensity finally using the Arduino board we can read the square wave output and get the result of the color. The photodiode has 3 different color filters 16 of them has red filters another 16 has green filters another 16 have blue filters and the rest of the 16 photodiodes are clear with no filters.

The Digital inputs and outputs allow the interface to a microcontroller or other logic circuitry directly. Output enable (OE) places the output in the high-impedance state for multiple-unit sharing of a microcontroller input line. At last, user can calculate the color of the light by RGB values. When the sensor is illuminated by a ray of light, the types of filters (blue, green, red, or clear) used by the device can be selected by two logic inputs, S2 and S3. Table 2 illustrates the relationship among S2, S3 and filter type.

S2	S3	Filter type
L	L	Red
L	H	Blue
H	L	Clear (no filter)
H	H	Green

Relationship among S2, S3 and filter type

TCS3200D consists of four categories of filters: red, green, blue filter and clear with no filter. A ray of light illuminates the sensor, the category of the filter used by the system can be choosen by two logic inputs, S2 and S3. Further relationship as mentioned.

Pin No.	Symbol	Descriptions
1	LED	Control the states of 4 LED indicators
2	OUT	Read the output frequency of RGB
3	S3	Combined with S2, select filters for different color lights
4	S2	Combined with S3, select filters for different color lights
5	S1	Combined with S0, select output frequency Scaling
6	S0	Combined with S1, select output frequency Scaling
7	GND	Power ground
8	VCC	Positive power supply (2.7V-5.5V)

Interface specifications

Port	Arduino pin
LED	3.3V
OUT	D2
S3	D3
S2	D4
S1	D5
S0	D6
GND	GND
VCC	5V

Connection between Arduino and the Module
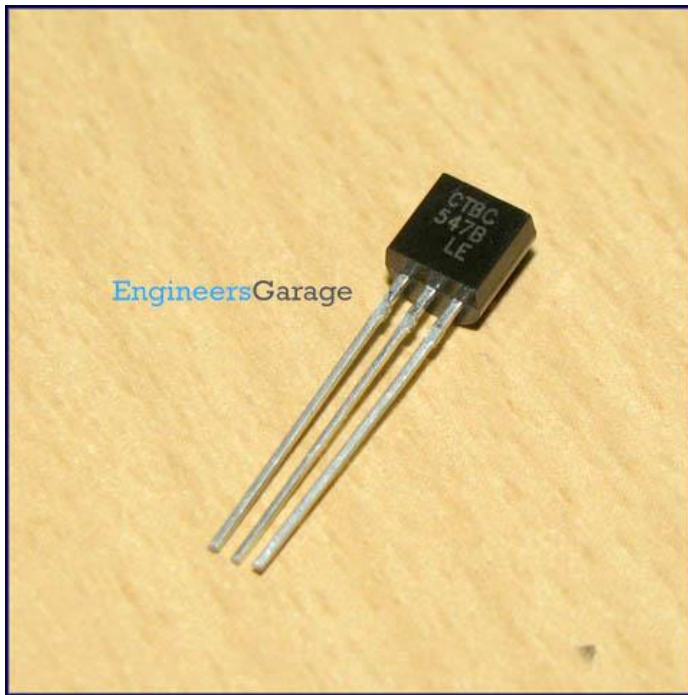
2.6 Transistor BC547 :

Figure: 12

BC547 is an NPN bi-polar junction transistor. Transistors are solid state devices used for amplifying, controlling and generating electrical signals. The transistors acts both as a switch as well as an amplifier and a small current present at the base controls a large current at the emitter and collector terminals.

There are two types of configurations PNP and NPN and the transistors are normally made by growing one region onto the other. The workings of the configurations is same as one another. The internal resistance of a transistor transfers from one value to another depending on the biasing voltage applied to the transistor. It can be used in two different modes one is forward bias and second the reverse biased mode. In forward bias it acts as a closed switch however in reverse bias the current through it is practically zero or it acts as an open switch at that time.

Pin Diagram:

Figure: 13

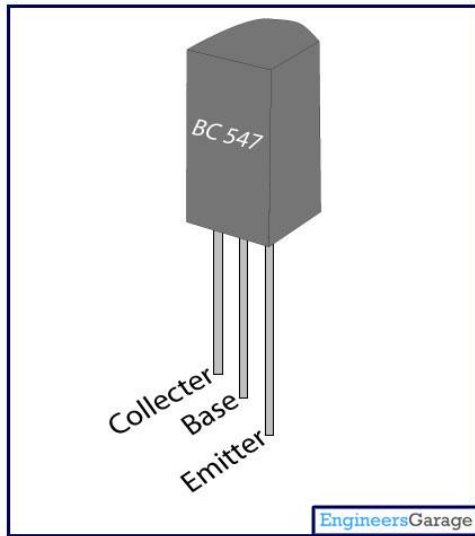## 2.7 TRANSFORMER :

Figure: 14

An electrical transformer is a device that is used to change voltage we can step voltage either up or down now what a transformer does not do is it will not change the available current you have in your circuit, it will also not change the frequency. Transformer work only on alternating current.
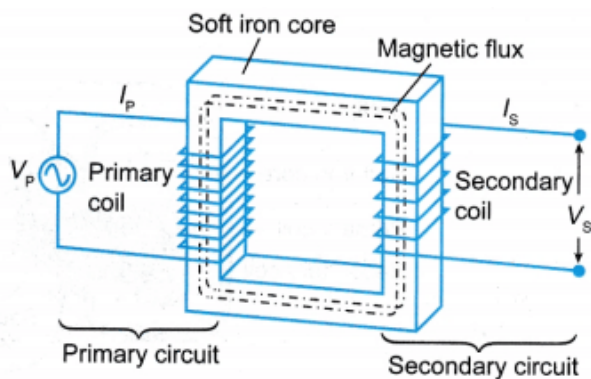
How does it works?

Figure: 15

Transformers receives AC power at one voltage and are capable of delivering it at any other voltage. So while transferring the power at longer distances they are able to achieve better transfer efficiency.

The transformers work on the basic principle of electromagnetic induction and in accordance to this principle an electromotive force is induced across it by the loop which is associated with a varying magnetic flux. This type of a fluctuating magnetic field can be produced easily by an alternating EMF system and a coil. A magnetic field is produced around it by a current carrying conductor. And the magnetic field produced by the coil is shown in the above figure. As the alternating current has a fluctuating nature, the magnetic field with which the coil is associated will also fluctuate. With the help a ferromagnetic material made core, the secondary winding can be effectively linked with this magnetic flux. And due to the electromagnetic induction an emf is induced in the secondary coil due to the fluctuating magnetic field. Since the turns are organized in arrangement the net emf incited over the winding will be whole of the individual EMFs prompted in each turn. Since the same attractive motion is going through the essential and auxiliary loops, the emf per turn for both the primary and secondary coils will be the same.

Types of Transformers :

Transformers are composed of an iron core ring wrapped in coils one coil is connected to an Ac input voltage and is called the primary coil the other coil is connected to an output circuit with a load resistance and is called a secondary coil. The two coils are all around protected or

insulated with each other and don't form a physical electrical association this gives the transformer its one of a kind electricity altering applications that can step up or step down any voltage.

Step Up Transformer:

In this the number of turns in the primary coil is less than that of in the secondary coil and hence the secondary voltage is bigger than the primary voltage.

Step Down Transformer:

In this the number of turns in the secondary coil now is less than the turns in the primary coil and hence the primary voltage is bigger.

2.8 SOLDERING IRON :

FIGURE: 16

A soldering iron is a hand tool that is utilized in soldering of wires . It supplies heat so as to melt the solder in order for it to flow into the joint in between the two work pieces. It comprises of an insulated wire and a heated metal tip.

Soldering Wire

Soldering wire is a metal alloy that is fusible and is used to join together metal workpieces and have a melting point that is below that of the workpiece.
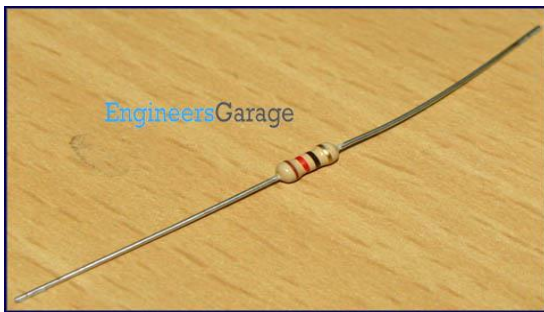
2.9 RESISTOR :

Figure: 17

2.10 DIODE 1N4001 :

Figure: 18

A diode is a device or component that allows current to flow in only one direction. Eg. LED, switch etc . also for an example there is diode connected so that it allows current to flow through the circuit however if we stop the circuit and disconnect the diode and turn it around to swap the polarity of it and then reconnect it to the circuit we'll see that no current is allowed to pass through the circuit, it stops the current from flowing because it is now what is called is reverse biased. Diodes are a semiconductor material which has the ability to both conduct and oppose the flow of current.

2.11 DC MOTOR :

Figure: 19

It's the one of the classes of the rotary electrical machines that can convert the direct current electrical energy into the mechanical energy and the most common types work on the forces that are induced by magnetic fields.

The working principle of dc motor is pretty simple, when a current carrying conductor is placed inside a magnetic field it experience mechanical force towards a particular direction.
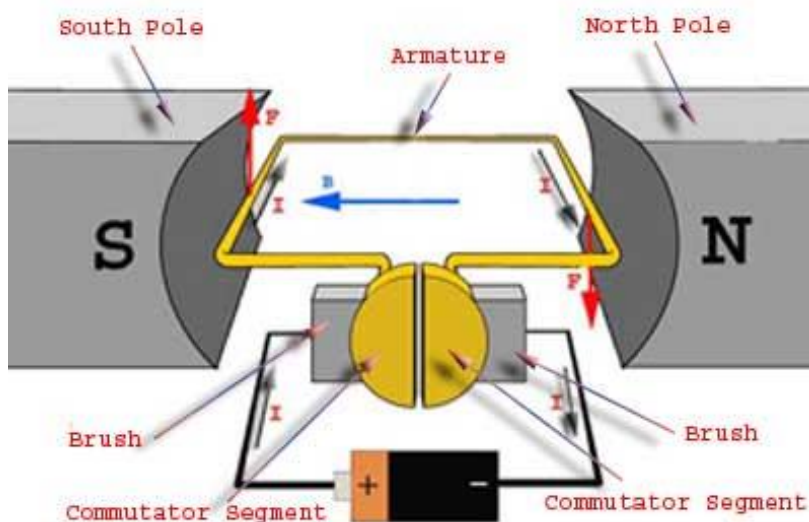
Figure: 20

Let us take a simple rudimentary model of a motor in which one single turn of conductor is set between two inverse poles that are the south and the north pole. Now on the off chance that we begin providing dc through a commutator framework to the single turn the current begins moving through it at that position where we can see that the negative terminal of the battery is connected with the right conductor of the turn and the positive terminal of the

battery is connected with the left conductor of the turn. The conductors are carrying currents and are placed inside the magnetic field and a mechanical force is experienced by both of them that will be acting in the direction of the mechanical force and by applying the fleming's left hand rule can be easily determines rather it is an upward or downward force due to which a torque is produced which tends to rotate the turn in clockwise direction after the clockwise 90 degree turn will come to a position that is vertical w.r.t. that of the magnetic field and at that position the conductors of the turn won't be having any current, but because of moment of inertia the turns will continue to rotate, but now the position of the turns has been interchanged, and again mechanical force acts on the conductors and the process continues again.

2.12 CAPACITOR :

Figure: 21

A passive component that is used for storing the charge is called the capacitor. Capacitors offer boundless reactance to zero frequency so they are utilized for passing the AC signals and blocking or resisting the DC signals or components. The capacitor experiences a recursive cycle of charging and releasing or discharging the chrge in AC circuits where the voltage and current across relies upon the RC time consistent. Hence for this reason they are used to even out the power supply variation.

2.14 IC 7805 (VOLTAGE REGULATOR IC):
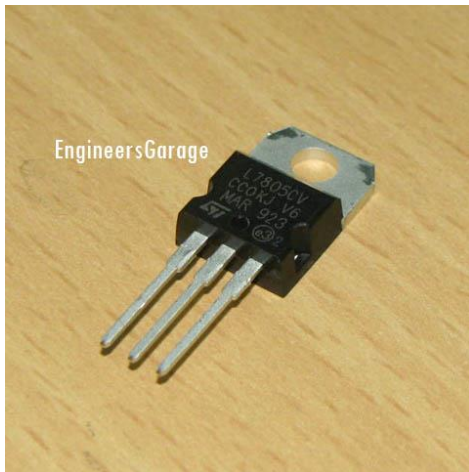
Figure: 22

A voltage controller is a gadget that takes an unregulated input voltage that could be fluctuating after some time and gives out a voltage that is regulated perfectly. Now 7805 is a voltage controller IC that belongs to 78xx series of the fixed linear voltage controller ICs. This voltage controller IC maintains a steady value of the output voltage.

Pin Diagram:
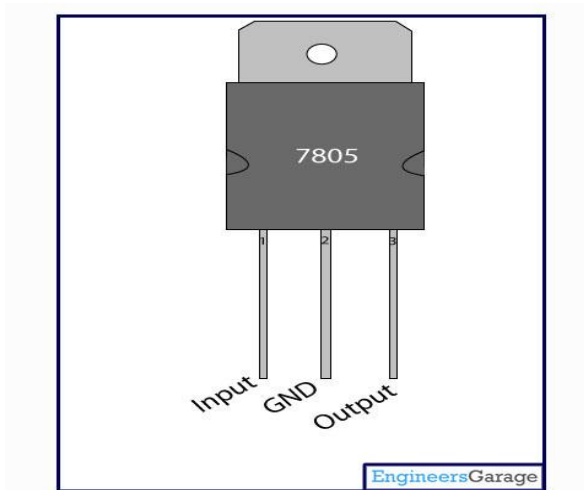
Figure: 23

Pin Description:

Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

This is the fundamental L7805 voltage controller, which is a three-terminal positive controller with a 5V fixed output voltage. This fixed controller gives a local regulation ,limiting the internal current, thermal close down control, and safe area insurance for your project. Every last one of these voltage regulators can yield a maximum current of 1.5A.

2.15 CONVEYOR BELT :
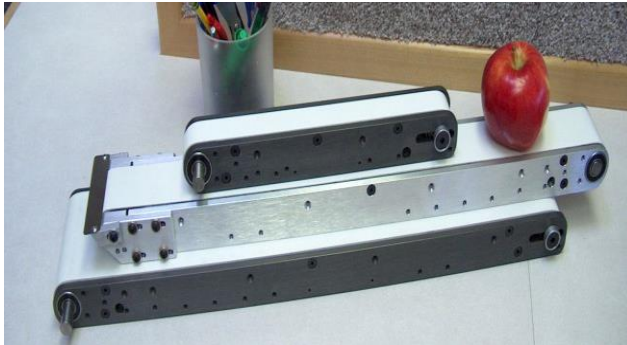
Figure: 24

2.16 BREADBOARD AND JUMPING WIRES :
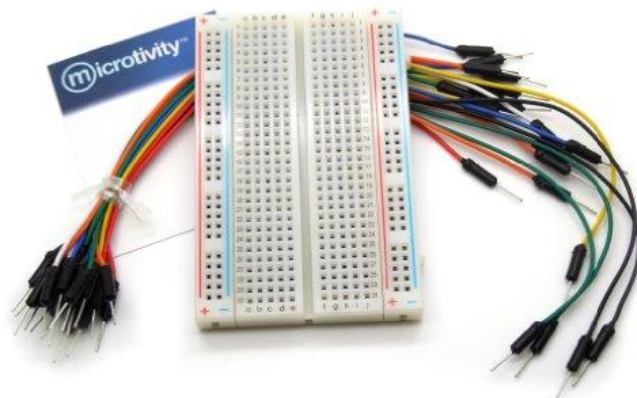
Figure: 25

2.17 ACTUATOR :

Figure: 26

Actuator is a device that produces a motion by converting energy and signals going into the system. The motion it produces can be either rotary or linear, here in our project we will use a linear actuator. Linear actuator produces a linear motion that is it can move in forward or backward motion set on a linear plane. The linear actuators are limited to a set path here we are working on a mechanical actuator that will produce a linear motion.

These actuators are used in cars for central locking. A rack and a pin in the motor is used to get the motion which is linear. Giving power to one pole extends the rack. For very short interval of time the power is given. Because in case of more power they can burn out.

CHAPTER - 3
LITERATURE SURVEY

- **Development Of Industrial Automatic using Multi Colour Sorting and Counting Machine by Amitesha Sachdeva, Mahesh Gupta, Manish Pandey, and Prabham Khandelwal.**

    Surviving in highly competetive industrial manufacturing, the supply of raw material through quality manufacturing is vital. The efficiency is mandatory which incorporates the speed of the production, lowering material and labour cost. By picking the objects which are coming from conveyer belt and then thereby placing in the particular basket by sending signals to the microcontroller using robotic arm. The arm picks the object and puts them back in the required or specified place. So this automatic color sorting has really wide implementation. According to its color the objects are identified. Though the project has only few limitations but used widely with few implementations.

- **Sorting of objects using image processing on the embedded platform by Hongshe Dang, Jinguo Song, Qin Guo.**

    They have proposed natural product measure recognizing and reviewing framework in view of picture handling. Taking the fundamental processor as ARM9 it builds up the natural products measure distinguishing program utilizing picture preparing calculations on the Embedded stage. To dissect the organic product's highlights; measure, shading, shape and the review is resolved in light of the highlights. From the mix of cutting edge plans, master creations and programmed mechanical control. J. V. Frances, J. Calpe, E. Soria, M. Martinez, A. Rosado, A.J. Serrano, J. Calleja, M. Diaz gave a strategy to enhance the execution.

- **Machine Vision Techniques for Automatic Mango Fruit Sorting and Grading Based on Maturity Level and Size by C. S. Nandi, B. Tudu and C. Koley.**

    750 number of unsorted mangoes of five varieties were accumulated from three gardens, located at different places. In three batches they accumulated mangoes with

an interval of one week. 50 numbers of a single variety in those 250 mangoes. For randomness of mangoes further steps were taken. Each mango were made unique with their variety by some number regarding the batch, the garden, etc. On the conveyer belt each and every mango was passed to check the maturity level. These were then stored in the proper manner after transportation.

- **Automatic Color Sorting Machine Using TCS230 Color Sensor And PIC Microcontroller by Kunhimohammed C.K, Muhammad Saifudeen K.K, Sahna S, Gokul M.S and Shaez Usman Abdulla**
For automatic sorting of objects on the basis of color a prototype was designed. The sensor TCS230 is used to know the color of the product and the microcontroller PIC16F628A to control the prototype. Number of conveyer belts used are two. To differentiate the products, separate sections are there for specified products. The processor belt is for the products to be analyzed by the sensor and the successor belt is for moving the container. This enhances high speed production and further provide accuracy and quality.

- **Development of an automatic color sorting on the belt conveyer by Sattom Halder, Md. Kamrul Islam, Mahmood Sabria Chowdhury and S.C. Banik.**
The important attributes to sort out an object are color and the size for better accuracy. So optical sensors are used for detection and sorting. The main sorting device being the color sorting machine sense the individual color of the object and put the objects back into the other conveyer belt. There are two conveyer belt. When things circulate from one location to other on the conveyer belt, signals will be send to the microcontroller by the sensor. The whole controlling of the process will be carried by the controller as it provides the instructions for actuator and sensors to work. The result was excellent with good accuracy. Red or green colored objects were identified and were kept in their baskets. The roller made the belt move with efficiency. The system performed the programmed task efficiently.

CHAPTER – 4

METHODEOLOGY

Just like Cell phones emit waves these colours are simply light waves. Real colors are interpreted by our brain cells. The three main colors that is red, blue and green, the sensor uses filters of these three colors and thereafter compare that value on the light reflected on it. This value taken will go to Arduino and it will tell us the color of the object.

The design is programmed consisting of the color sorting code using Arduino software. To recognize and sort out a programming code is researched.

The controller or the microcontroller used is Arduino Uno which is connected through connecting wires. To different and individual locations the motor servo slides the ball right and left at distinct angles.

The hardware comprises color sensors, connecting wires and the actuators. The code used is embedded C in the software Arduino UNO.

Step by step process-

Step by step process-

Our project works as an automatic color sensing and sorting machine and uses TCS3200, Arduino microcontroller and actuators. The Arduino board gets the signal from the color sensor TCS3200 and the sensor is connected with the Arduino with the help of the jumper wires and there connection table is shown above.

We can use the power supply of the Arduino using 2 modes by using directly the usb cable from the adaptor or by using the power jack of the Arduino so if we want to get data on which of the color is coming in front of the color sensor we can connect the one end of the usb cable directly to our laptop and see what type of value is coming out of this color sensor so whenever the sensor senses the color blue, it will show that data on the laptop and same with the red and the green color the data is shown through the serial port of the Arduino board.

Then we have the relay board consisting of 4 relays r1, r2, r3 and m that are basically controlling the actuators and the motor where m is for the rotor motor and r1 r2 and r3 relay is for the three actuators(which are basically taken from cars and works on the phenomenon

of centre locking system that is on or off) on different positions that will throw the color blue, green and red respectively and each relay is connected with a LED. The one in front of m will stay on throughout the process indicating that the power supply is being continuously given to the dc motor hence moving the conveyor belt and the LEDs in front of the relays r1, r2, r3 will blink in accordance with which of the actuator is working. We are also using a free rotating wheel on one side of the belt and on the other side we are using a johnsons gear motor which has a high torque that is connected to the relay board.

Then we are using a power supply board for four systems that is the three actuators and the motor and we have used high current 2A 12V transformer so that it can drive the motor and the three actuators as these are using a very high amount of current. Now talking about the power supply board it has rectifiers, we have used high current 5408 diodes so that they can provide maximum amount of current to the motor and the actuators, also 5 capacitors are being used one of which is a 104 capacitor and the other 4 are 470uF, 1000uF, 100uF, 4700uF they are working as a filter as we know that the output of a bridge rectifier is not pure dc, it has ripples and fluctuations so for bypassing them these capacitors are used.

For the transformer directly 230V ac is being supplied to it and the 230V ac is converted to 12V ac using the step down transformer so now this 12V ac means that on the transformer both the primary side and the secondary side is ac the only difference is that one side has a high voltage. So we know the first step to convert the ac into dc is using rectifiers which will convert it into dc but that won't be pure dc and that's why the use of the capacitors. Also on the relay board 2 transistors are used for each of the four relays , the transistor acting as a driver for each relay.

Also as the microcontroller output is not so high so we have to amplify the current coming out from the microcontroller so that the relays can be derived so the transistors here are used as a amplifier and each two transistors are connected in a darlington pair form and the diodes in front of the relays act as a back emf bypasser as we know that every device that is being on and off produce a back emf, and if the diodes are not used they may effect the circuit in the backend and may burn out the Arduino board as well.

So now for the working of the project we first apply the power supply to the Arduino and then apply the power supply to the transformer because when the power supply is not being supplied to the Arduino then automatically the four relays will get on as the relays can get on at a 0 signal which would already be there without the connection of the Arduino with the power supply, and that will put a load on the transformer and could result in hanging of the whole system but when the power supply is given to the Arduino before that the Arduino will on only one relay that is the relay that will derive the motor and all the others are off. And we are using a toggle button from which we can on and off the whole arrangement except the Arduino.

So we will on the serial port of the laptop and see that different values of the color red green and blue coming on the screen. Now if we will put the color green in front of the color sensor it will send the back the frequency of the color signal back to the Arduino which will then run the code accordingly and corresponding actuator will move and put the green colored object in its respective block and the similar process will be done for the blue and the red color.

Interfacing of motors with a controller yields overload on the whole thing. To remove this drawback the motor driver circuit is used to yield high current to the motor. L293D IC is used to built motor driver circuit. Arduino uno takes low level input signal because the driver circuit is supposed to take low level input signal. To get high voltage and current to motor for its appropriate operation this is done. Motor is used to drive the slider over the detected color station. Motor operation is fully controlled by an arduino. L293d is supposed to drive current up to 600mA with voltage 4.5V.
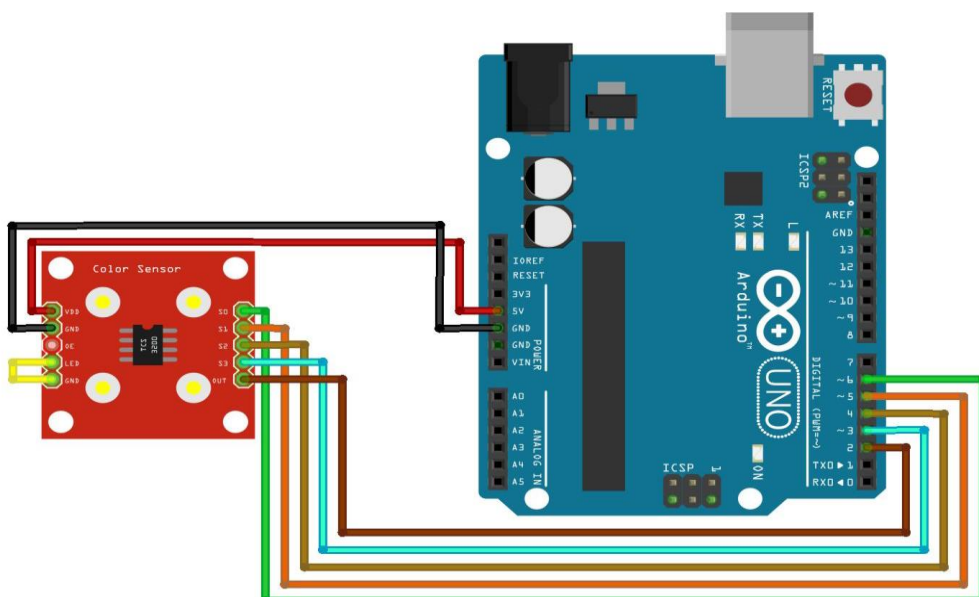
PROJECT LAYOUT:
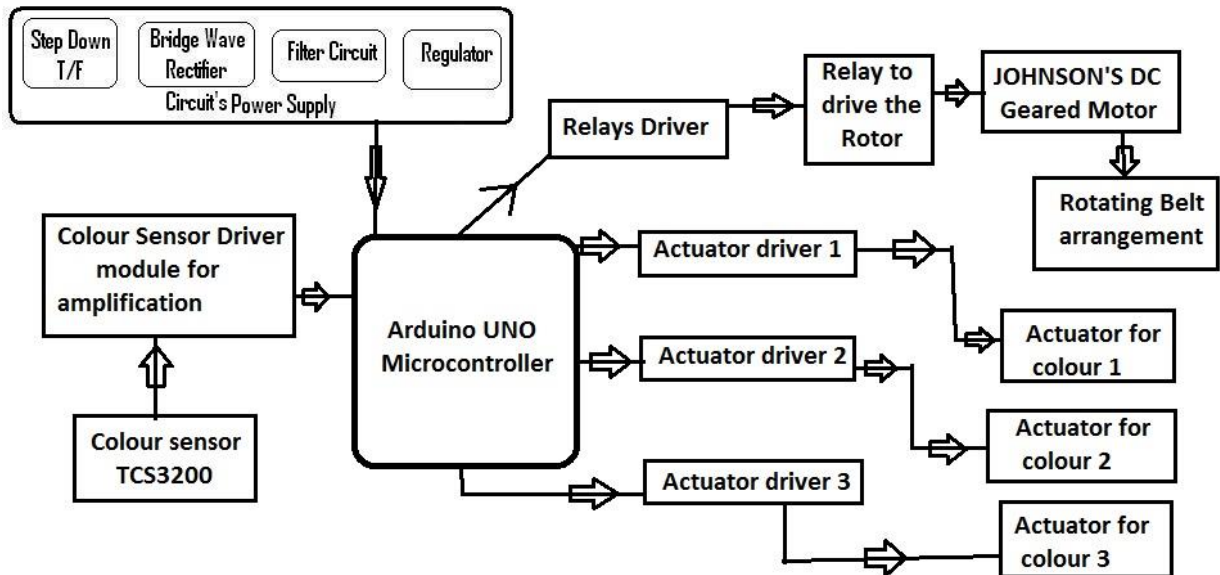
CHAPTER – 5

5.1 SOFTWARE

Embedded C is the arrangement of the language expansions for the programming language C.

To find shared characteristic issues which involves in the middle of C extensions by the C norms board of trustees for particular implanted frameworks.

Verifiably, embedded C programming needs non standard extensions to the C to improve the fascinating highlights including for instance settled point number juggling, different particular memory banks and essential information yield activities.

CODE

The four pins of color sensors S0, S1, S2, S3 are connected to pin number 2,3 ,4 and 5 of arduino.

rl1, rl2, rl3 are relays running the three actuators and mt is the motor running the dc motor. These pins are connected to the driver of the relay and then relay will drive the actuators which will throw the colored object.

The output pins are S0, S1, S2, S3, rl1, rl2, rl3 and mt. The input pin is the sixth pin of arduino. Now the motor is made low because relay works only when motor is low and relay is off in case of high signal. Firstly all the actuators are off only the rotor is on.

Frequency is set to 20%. Hence S1 is low and S0 is high.

Serial port connections are done. Why serial port? We are connecting the laptop with the hardware so we want all the data coming to the laptop for example which color is coming blue, green or red.

Then there is a loop which reads the color from the function. Switch function is used for different colors.

For case 1 the color is red

A delay of 1330ms is taken and then the actuator is on for 120ms. It will take out the red color from the belt.

Similarly the other two cases. The only difference is in the delay. Since actuators are at different positions in order blue, green and red. Red is at the last position so it will take more time and blue will take least time.

If S2 and S3 are low and low it will sense red color. If high then green color. If S2 is low and S3 is high then it will sense blue color. Pulse in reads frequency and comes at the sixth pin i.e. sensorout.

After getting frequency value from color sensor. Comparing these three factors and colors are identified. Value of color taken now.

```
  }

  color=0;
}
// Custom Function - readColor()
int readColor() {
  // Setting red filtered photodiodes to be read
  digitalWrite(S2, LOW);
  digitalWrite(S3, LOW);
  // Reading the output frequency
  frequency = pulseIn(sensorOut, LOW);
  int R = frequency;
  // Printing the value on the serial monitor
  Serial.print("R= ");//printing name
  Serial.print(frequency);//printing RED color frequency
  Serial.print("   ");
  delay(50);
  // Setting Green filtered photodiodes to be read
  digitalWrite(S2, HIGH);
  digitalWrite(S3, HIGH);
  // Reading the output frequency
  frequency = pulseIn(sensorOut, LOW);
  int G = frequency;
  // Printing the value on the serial monitor
  Serial.print("G= ");//printing name
  Serial.print(frequency);//printing RED color frequency
  Serial.print("   ");
```

```
    break;
    case 2:

        Serial.println("GREEN");

            delay(910);
        digitalWrite(rl2, LOW);
         delay(120);
        digitalWrite(rl2, HIGH);


    break;
    case 3:

        Serial.println("BLUE");

            delay(400);
        digitalWrite(rl3, LOW);
         delay(120);
        digitalWrite(rl3, HIGH);


    break;

    case 0:
    break;
  }
```

File Edit Sketch Tools Help

test_code

```
//#include <Servo.h>
#define S0 2
#define S1 3
#define S2 4
#define S3 5
#define mt 7
#define rl1 8
#define rl2 9
#define rl3 10

#define sensorOut 6

int frequency = 0;
int color=0;
void setup() {
  pinMode(S0, OUTPUT);
  pinMode(S1, OUTPUT);
  pinMode(S2, OUTPUT);
  pinMode(S3, OUTPUT);

    pinMode(mt, OUTPUT);
      pinMode(rl1, OUTPUT);
    pinMode(rl2, OUTPUT);
      pinMode(rl3, OUTPUT);
```

```
⊙⊙ test_code | Arduino 1.8.3
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 test_code §

  pinMode(sensorOut, INPUT);


   digitalWrite(mt, LOW);
    digitalWrite(rl1, HIGH);
     digitalWrite(rl2, HIGH);
      digitalWrite(rl3, HIGH);

//setting frequency scaling to 20%
  digitalWrite(S0, HIGH);
  digitalWrite(S1, LOW);

  Serial.begin(9600);
}
void loop() {


  color = readColor();
  delay(10);
  switch (color) {
    case 1:

      Serial.println("RED");
      delay(1330);
          digitalWrite(rl1, LOW);
           delay(120);
          digitalWrite(rl1, HIGH);
```
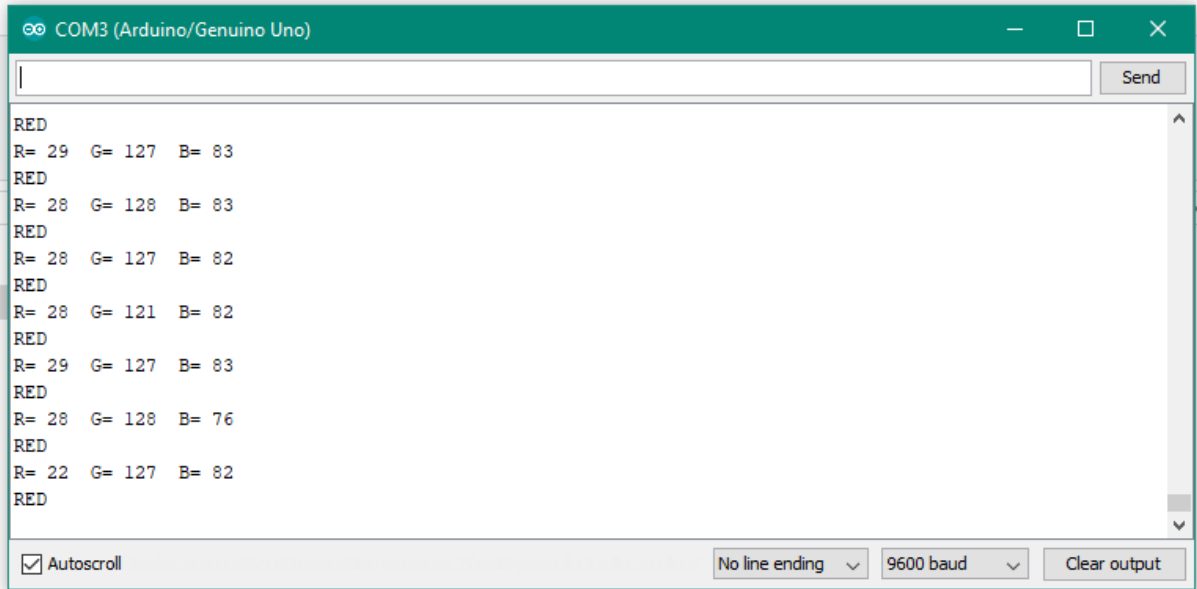
```
Serial.print( G= );//printing name
Serial.print(frequency);//printing RED color frequency
Serial.print("  ");
delay(50);
// Setting Blue filtered photodiodes to be read
digitalWrite(S2, LOW);
digitalWrite(S3, HIGH);
// Reading the output frequency
frequency = pulseIn(sensorOut, LOW);
int B = frequency;
// Printing the value on the serial monitor
Serial.print("B= ");//printing name
Serial.print(frequency);//printing RED color frequency
Serial.println("  ");
delay(50);
if(R<45 & R>12 & G<135 & G>88){
  color = 1; // Red
}

if(R<65 & R>28 & G<65 & G>23){
  color = 2; // Green
}

if (G<120 & G>55 & B<62 &B>13){
  color = 3; // Blue
}
return color;
}
```

RESULT

When no object is in front of the color sensor then the output is

```
COM3 (Arduino/Genuino Uno)

                                                          Send

RED
R= 29  G= 127  B= 83
RED
R= 28  G= 128  B= 83
RED
R= 28  G= 127  B= 82
RED
R= 28  G= 121  B= 82
RED
R= 29  G= 127  B= 83
RED
R= 28  G= 128  B= 76
RED
R= 22  G= 127  B= 82
RED

☑ Autoscroll          No line ending ∨   9600 baud ∨   Clear output
```

Now when we put the objects
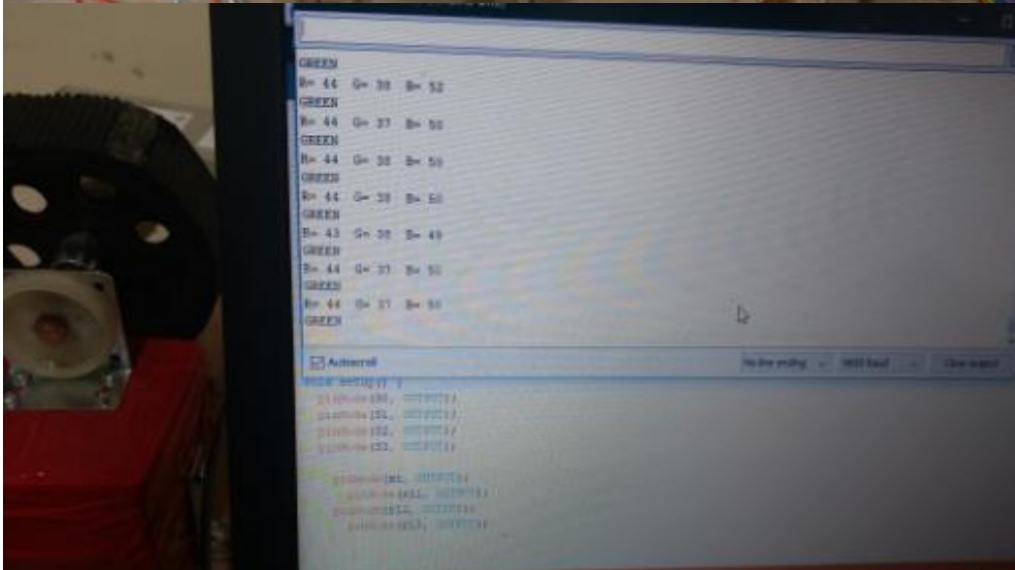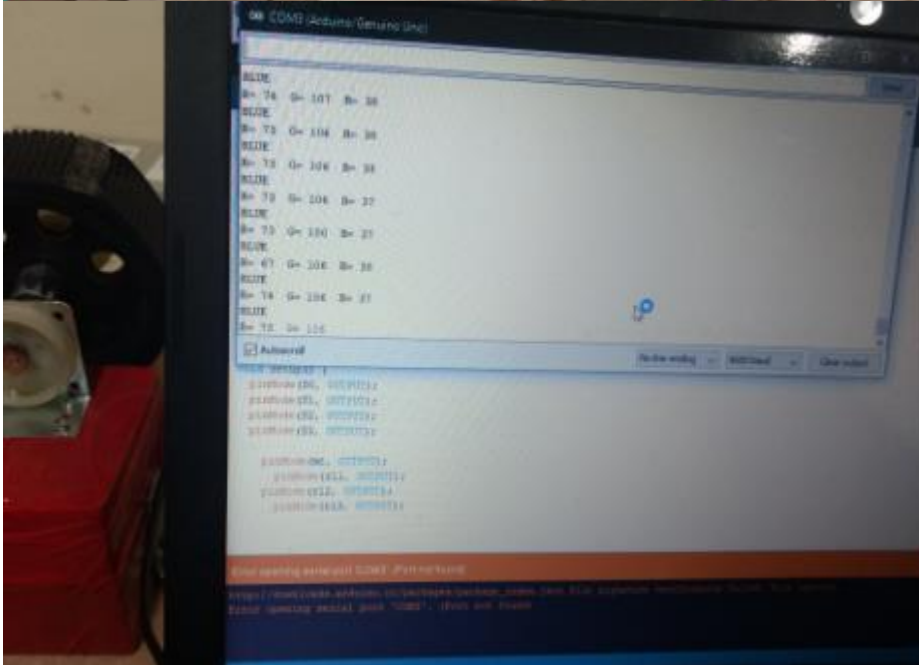
CHAPTER - 6

6.1 APPLICATIONS-

Highlights of the sorting technique are as follows:

- Identification of color which further sorts the object and keeps them in individual baskets.
- After accumulating specified objects the number of the cluster can be counted and this is how each individual color objects can be counted using sensors.
- The manufacturer finds it difficult to get supply of the separated products in a systematic order. So the handling of the products and the material becomes easy and this enhances speed of production.
- The workshops, the labs and many other areas it is used.
- In the malls and in the airports it is widely used. Also in museums.
- In the industries of food and diamond separation of   rice, coffee, tea, cereals, pearls etc. is a challenge which can be solved using this project.
- The microcontroller Arduino Uno, is utilized to upgrade the speed of shading arranging. The precision of shading reviewing is the other test. In the present assembling industry this procedure by an administrator is low. Since an administrator should deal with hundreds or thousands of items each day, deplete framework will prompt a blame. This problem won't occur in machines. Accuracy is an advantage in a machine until fault occurs in the system. The cost of color sensors are though high.
- The idea of library automation can be achieved with the help of this project.

Other applications: -
- This system is utilized as a part of numerous building fields, for example, mechanical autonomy, modern picture handling, nourishment preparing and different fields.
- The system had likewise discovered valuable for assurance creepy crawly invasion in grains and flaws in products of the soil.
- Major territories of use of PC vision technology in nourishment industry incorporate quality assessment of sustenance grains, organic products, vegetables and handled sustenances, for example, chips, cheddar and pizza.

6.2 Limitations –

Every invention or the system has its own limitation.

- In this sorting system sometimes the slip of the belt due to grease on the roller or motor can occur.
- The mechanism is though good enough but absence of the timing belt causes the faulty power transmission into the roller.
- Also it won't be helping us with the detection of organic fruits or food because of their ranging maturity level.
- Since for particular attributes only the code is set so in case the fruit or any natural thing which changes color won't be detected afterwards.

6.3 Further Development -

The system can be updated using following methods:

1) Rather than direct connection with roller and motor shaft you can use timing belt and gear which will prevent thr power loss transmission to the roller.Proper care should be taken with the timing belt and gear.
2) You can use rubber grippers which are of gripper so that it increases or enhances the surface resistance which will then avoid slipping of the conveyer belt.
3) You can use the color sensor TCS230 though it is not that much cost effective.
4) Actuator which is pneumatic should be used for grading and placing the objects in different baskets.

6.4 CONCLUSION -

This developing technology of arranging or reviewing of articles has tremendous advantages to the nation. Maybe a couple of the other related advantages consolidate more effective activity, generation of more steady item quality, more prominent item dependability and security. For review and assessment purposes it has been utilized as they can give quick, economic, clean, predictable and target evaluation. Despite the fact that sufficiently effective and precise calculations have been created, preparing speeds still neglect to meet present day fabricating prerequisites. With couple of special cases, inquire about in this field has managed trials on a research facility scales and consequently it needs more engaged and nitty gritty investigation.

Nowadays living in this aggressive world the assembling business require tremendous measure of supply of crude material. The administration of the supply of the items utilized as a part of the business incorporated from crude material to the completed item is extreme and imperative. For the items bearing high caliber and dimensional exactness is required. So this task of programmed shading arranging is a decent one since it has an astounding working guideline with its wide usage. This thought of the task is connected in the enterprises to sort and grade. Despite the fact that it has a few constraints, yet by having done some change this idea can be executed in extensive variety of use.

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