PACKINGING MACHINE

Abstract-

In India, the industry is largely dominated by ready to eat segment, which contributed to 90 percent of total sales of packed foods in India FY2013. The industry contributes to 1.3 to 1.5 percent of India's GDP. Contribution of this industry in manufacturing GDP in FY2012 stood at 14 percent. Every company has different Strategy for its products strengthing and marketing which comes from the packaging of food materials and its content. In India the small industries are not able to established their product business and marketing because of their product value and content in comparison with other OEM in their branding value and packaging so, to increase their value, design of low cost packaging machine and also synchronization with their assembly line with help of virtual environment provide a greater advantage to know better about their process line and their feasibility for a long term goal. Our main focus was on how we can reduce the cost of packaging machine to benefits the small scale food packaging industry and provide a greater benefits, by designing in virtual environment and simulating with their assembly line for present and long term benefits.

Automation has made a tremendous impact on many industries other than manufacturing. Currently automation is taking on the manual operations that are been carried out in the industries. Automation reduces human effort and completes the job in minimum time. The main intention of this paper is to implement automation in small scale filling industries because the small scale industries go for manual operations to manufacture, filling. These industries requires large amount of labor for operating the machines, and to increase the production rate. The expensive PLC boards that are used in large scale filling industries are replaced by an ARDUINO UNO board which is much cheaper than the PLC's. The manual filling process has many shortcomings like spilling power out while filling it, equal quantity may not be filled, delay due to natural activities of human etc. In this paper we have tried to overcome those problems.

The main purpose of this project was to provide the small sector food industry (MSME) with a platform that they are able to process their food item in safe packets by reducing the cost of packaging machines. In comparison with the large OEMS who have multi brand packing system show case their nutritional value of their products and additional information regarding show case and other information, which provide them a great source and huge marketing opportunity in business and customer satisfaction. We did it through designing the whole machine in virtual environment (solidworks) where every component was based on standard available mainly electronic part for automation (semi automation).Weight checking was removed by adding volumetric cup filler according to product packaging of particular industry. The design and simulation was based on the company layout factory area where we took it on virtual environment and simulated it .The synchronization of machine was done according to the controller employed in the control of machine for sealing of the packets of food items. Arduino based automation system was employed for automation.

Nowadays, world is moving towards automation. Same goes with food industries. Automation will improve quality and quantity of their product to meet customer demand[1]. The automation of bottle filling involves use of cylinder, pneumatic system and PLC to operate but it is costly. Even though all of this available on market, but there are small industries still using manual method to filling up the bottle. The constraint for them not to use these convenient technology is due to the cost of the

machine. This study focus on create a system to measure liquid volume filled up inside the bottle using Arduino and build a prototype of low-cost filling machine. Arduino microcontroller is cheap and very reliable to do the task. Before filling machine using cylinder and pneumatic developed, workers needs to manually filling up the bottle using taps and tanks. It bring many disadvantages to the product and the company itself. Water spilling out, quantity of water is not the same, slow in production, hygiene problem and can cause loss to the company. Automatic filling machine will reduce these disadvantages and labor cost can be reduced and eliminate other problem faced by small food industries [2]. Production process will be smooth, number of man power and production time will reduce and the most important the cost will be lower. Rajesh G. Khatod, Chandrashekhar Sakhale and their team members developed a less complexity and less cost chemical liquid dispenser machine for pharmaceutical industries[3].

LITERATURE SURVEY

Present Theories and practices (should not exceed 2 pages)

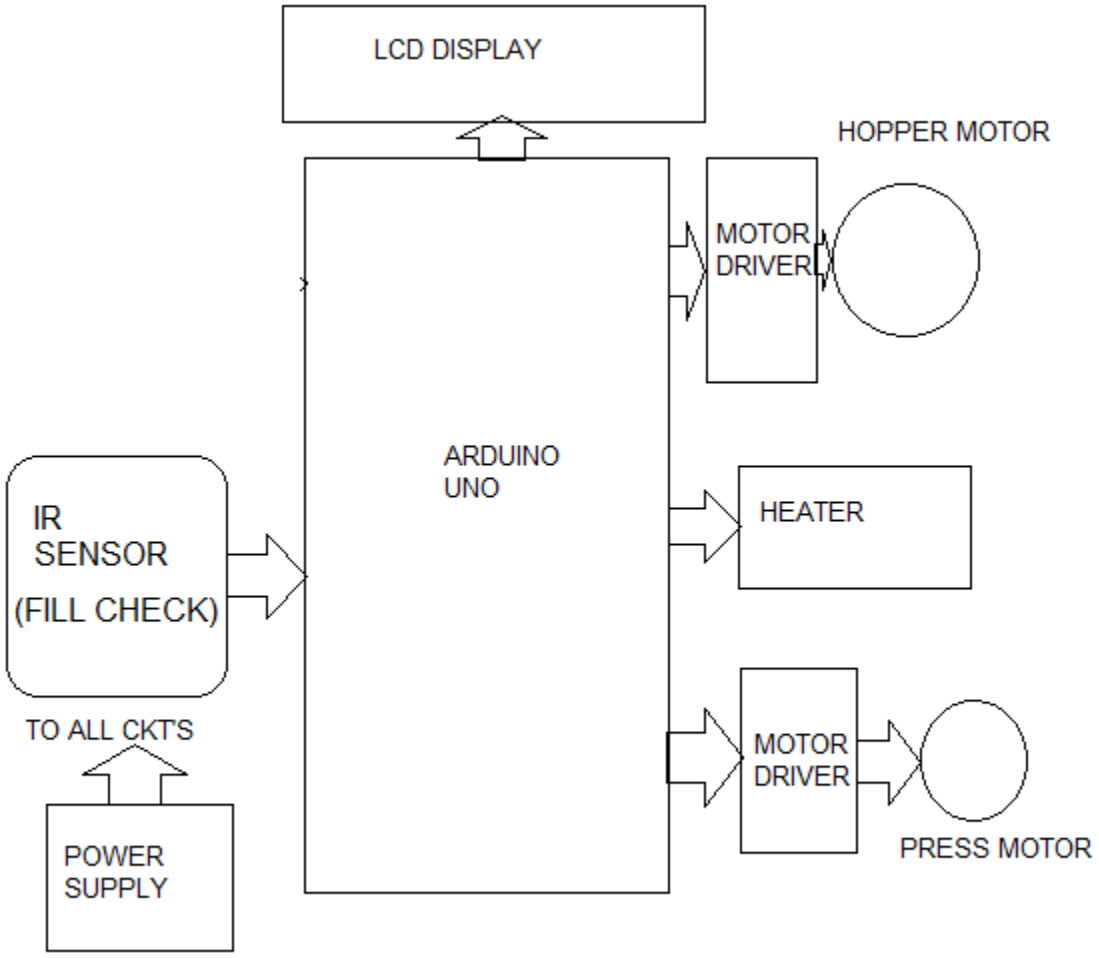
Sr. No.	Author	Year	Methodology/Design etc	Conclusion/Future scope etc
1	A.P Singh, Rakesh Kumar Chaurasia Mechanical Engineering Department , IPEC Ghaziabad, INDIA	2016	The design process was based on survey of different packaging machine based on type of automation and cost and working life. A details study of process and time consumption was made according to the data collected from different industry, their every process from raw materials to finish product was inspected and decision were made according to the customer specification and requirement. Also the system design for automation was done by our internal guide who is working on different automation. Finally he suggested us to idea for automating with Arduino board. Also	So by using this auto weighing control system we totally overcome this problem by Arduino, will handled all the operation regarding the weight, timing of the job.

			simulation was done to analyze the different results related to load and safety. Constraints and load were given according to weight upon the whole structure.	
2	Automated Bottle Filling & Capping Machine using ARDUINO Mr.Lakshmeesha, Mr.Prajwal Kotian,Mr.Shetty Ganesh, Mr.Srigansh Institute of Engineering and Technology, Mijar, Moodbidri, Mangaluru, Karnataka	**2015**	The fluid level in the hopper is checked and if the fluid level available is as per the requirement then the process begins. Firstly an empty bottle is placed on the conveyor belt. The motor is turned on and the conveyor belts starts to rotate and thus it moves the empty bottle. An IR sensor which is placed below the hopper senses the presence of bottle. The conveyor stops working and pump will remain on till the desired period. Filling process continuous until the bottle is completely filled, after which the pump is turned off and the conveyor belt starts. Now the bottle is moved forward to its final position. At final position, an optical sensor is placed which detects the presence of filled bottle and displays the number of filled bottles. Now, the bottle heads towards the capping section where it is detected by another IR sensor. A plunger with an attached spring is used for capping the bottles. Once	The main goal of this paper is to implement “arduino based automatic bottle filling and capping system”. The cost of machine installation is cheap and it is a less time consuming work as compared to manual bottle filling technique.

			detected by the sensor, the conveyor belt stops and the plunger rushes downwards and hits the cap of the bottle which is gently placed on the bottle. Due to the spring that is attached to the plunger, the plunger retracts after the capping is done. After the retraction process, the conveyor belt starts and the filling operation continues.	

Proposed work

Block diagram



POWER SUPPLY():-

RATINGS-12V/1Amp

Here we used +5v dc power supply. The main function of this block is to provide the required amount of voltage to essential circuits. +6voltage is given to motor via motor driver. To get the +5v dc power supply for controller & sensors we have used here is IC 7805, which provides the +5 Vdc regulated power supply.

Lcd Display

Liquid crystal display (LCD) has material which combines the properties of both liquid and crystals. They have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an order form similar to a crystal.

Fig 5.1.1 LCDmodule

More microcontroller devices are using 'smart LCD' displays to output visual information. The following discussion covers the connection of a Hitachi LCD display to a PIC microcontroller. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 8 x 80 pixels of the display. Hitachi LCD displays have a standard ASCII set of characters plus Japanese, Greek and mathematical symbols.

Hardware Diagram

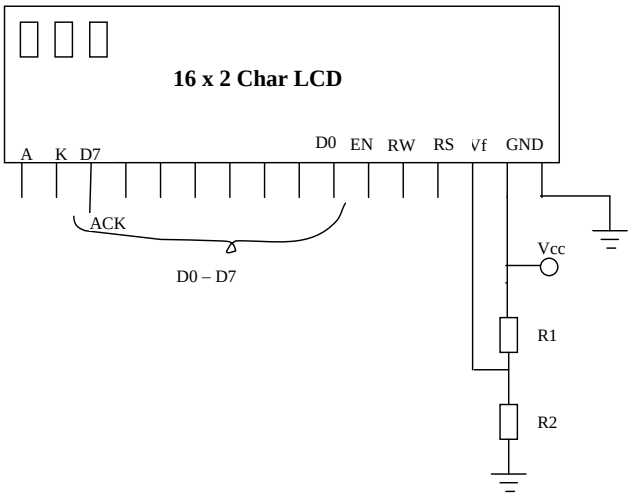


Fig 5.1.2 LCD pin configuration

For an 8-bit data bus, the display requires a +5V supply plus 11 I/O lines. For a 4-bit data bus it only requires the supply lines plus seven extra lines. When the LCD display is not enabled, data lines are tri-state which means they are in a state of high impedance (as though they are disconnected) and this means they do not interfere with the operation of the microcontroller when the display is not being addressed. The LCD also requires 3 "control" lines from the microcontroller.

When the LCD is initialized, it is ready to continue receiving data or instructions. If it receives a character, it will write it on the display and move the cursor one space to the right. The Cursor marks the next location where a character will be written. When we want to write a string of characters, first we need to set up the starting address, and then send one character at a time.

Pins description

Pins Definition

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

Table 5.1 pins for LCD

IR SENSOR MODULE-

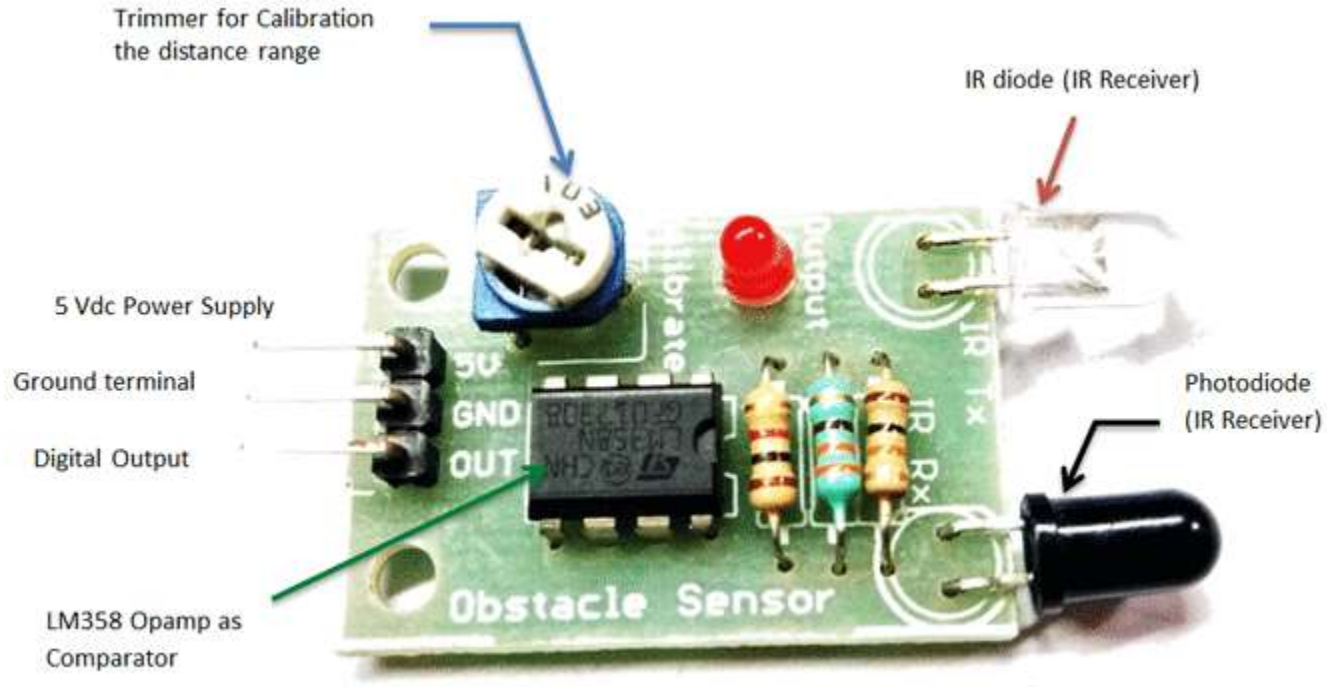
IR Sensor Module Pinout Configuration

Pin Name	Description
VCC	Power Supply Input
GND	Power Supply Ground
OUT	Active High Output

IR Sensor Module Features

- 5VDC Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

Brief about IR Sensor Module



The IR sensor module consists mainly of the IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer pot), output LED along with few resistors.

IR LED Transmitter

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feets, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in colour, so it can give out amount of maximum light.

Photodiode Receiver

Photodiode acts as the IR receiver as its conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

LM358 Opamp

LM358 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3).

Photodiode's series resistor voltage drop > Threshold voltage = Opamp output is High

Photodiode's series resistor voltage drop < Threshold voltage = Opamp output is Low

When Opamp's output is **high** the LED at the Opamp output terminal **turns ON** (Indicating the detection of Object).

Variable Resistor

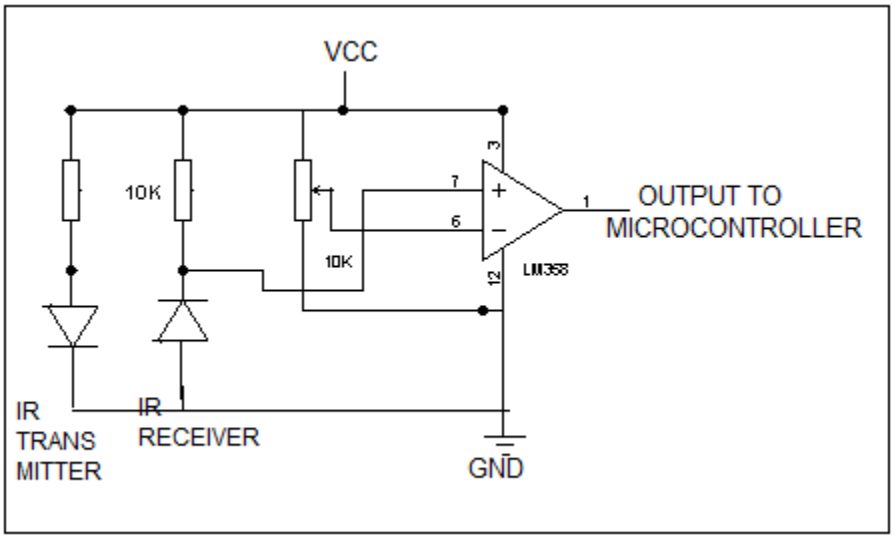
The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected.

IR SENSOR

General Description

The IR Sensor-Single is a general purpose proximity sensor. Here we use it for collision detection. The module consist of a IR emitter and IR receiver pair. The high precision IR receiver always detects a IR signal.

The module consists of 358 comparator IC. The output of sensor is high whenever it IR frequency and low otherwise. The on-board LED indicator helps user to check status of the sensor without using any additional hardware.



Working of circuits is very simple as we know LM358 compares the voltage applied at input pin and provide you the output. The voltage level which we want to detect is applied on either of the input pins and the voltage to be detected is applied on the other pin.

Above circuit is made for getting data or digital signal in the form of 5V(1) and 0v(0).

Sensor is connected in voltage divider circuit made up of 10k resistor(R1) and sensor(R2). When resistance of sensor changes then as per voltage divider formula

$$Vo=(R2/(R1+R2))x\ VCC$$

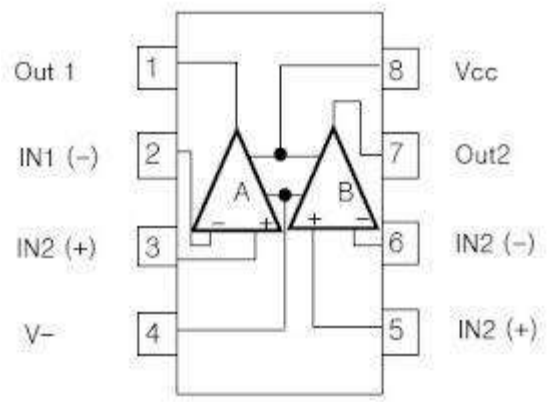
In our case VCC=5V and R1=10k hence value of Vo i.e. output voltage is totally depends on resistance of R2 and R2 depends on sensed data.

Now this sensed data which is converted into analog voltage using voltage divider is applied to comparator. In comparator this sensed data is compared with some set point. This set point is sensitivity of the circuit. Voltage is set at non inverting terminal using potentiometer where potentiometer is connected in between VCC and GND and variable terminal is connected to comparator. As we know that if VCC=5V and –VEE=0v then output of comparator will changes its state between 5v and 0v i.e. logic 0 or 1. So now if resistance of sensor will increase then voltage of divider circuit will increase which in turn increase voltage at non inverting terminal of comparator and it is more than set point at inverting terminal voltage then output of comparator becomes 1. And if sensor resistance is less then voltage at non inv. Terminal of comparator becomes less than inverting terminal set point voltage then output of comparator becomes 0.

In this way voltage divider and comparator circuit will convert change in resistance of sensor due to sensed parameter to digital signal this data is the given to microcontroller for further processing.

For comparison we have used LM385 comparator IC which has 2 comparators in single 8 pin IC.

IC LM358- LM358 consists of two independent, high gain operational amplifiers in one package. Important feature of this IC is that we do not require independent power supply for working of each comparator for wide range of power supply. LM358 can be used as transducer amplifier, DC gain block etc. It has large dc voltage gain of 100dB. This IC can be operated on wide range of power supply from 3V to 32V for single power supply or from ±1.5V to ±16V for dual power supply and it also support large output voltage swing.



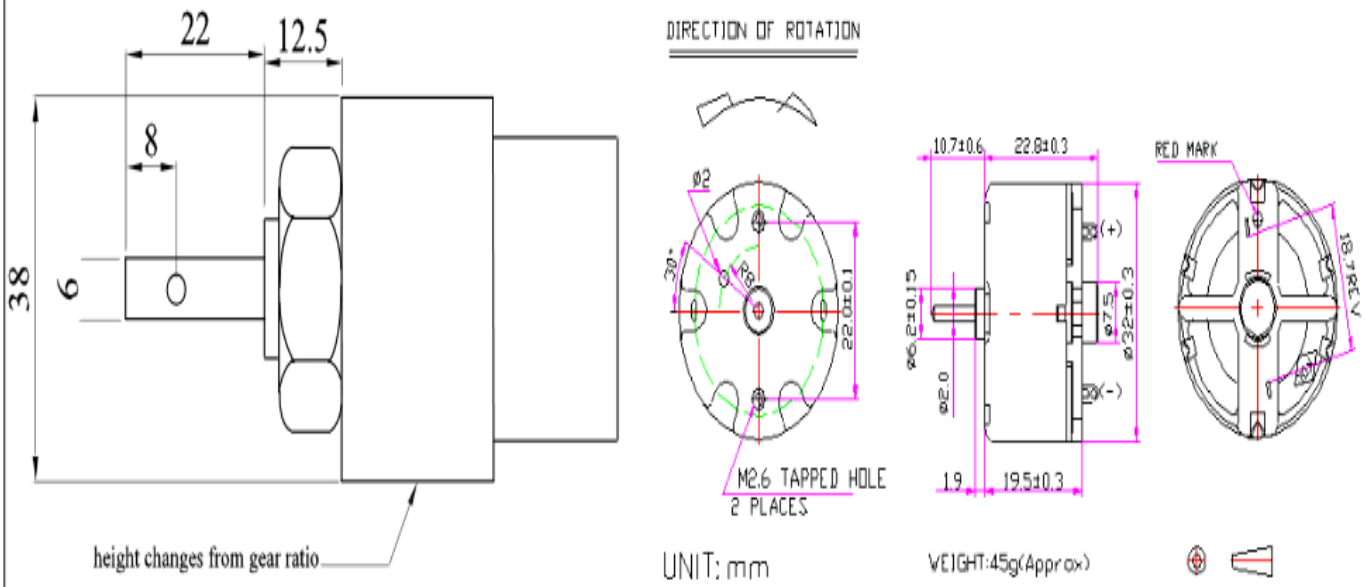
From the above figure you can see that operational amplifier has two inputs and one output in one independent LM358. Inputs are at pin 2 (negative pin) and 3 (positive pin), positive pin is used for positive feedback and negative pin is used for negative feedback. In ideal condition when no feedback is applied, gain of the operational amplifier should be infinite. When voltage at pin 2 is more than voltage at pin 3 it will raise the output towards the positive maximum voltage and a slight increase at negative pin compared to positive pin will lower the output towards the negative maximum. This feature of operational amplifier makes it suitable for the purpose of level detection.

INTRODUCTION TO DC MOTOR

K-series motor by Robosoft Systems available in various RPM
3.5, 10, 30, 45, 60, 100, 150, 200, 300, 500, 750, 1000

Gear box is made of white hard glass filled nylon ,gears are made of metal rotating on steel pins

Easy to mount by using a single M14 nut, hole required to insert the motor is 13.7mm ø
Over-loading of motor may result in short life or damage to gearbox.



MODEL		VOLTAGE		NO LOAD		AT MAXIMUM EFFICIENCY					STALL		
		OPERATING RANGE	NOMI-NAL	SPEED	CURRENT	SPEED	CUR-RENT	TORQUE		OUTPUT	TORQUE		CUR-RENT
			V	rpm	A	rpm	A	mN.m	g.cm	w	mN.m	g.cm	A
K series	12560	3.0-18	12	2700	0.020	2200	0.080	0.98	10.0	0.23	5.88	60	0.5

DC MOTOR DRIVER
L293D QUADRUPLE HALF-H DRIVER

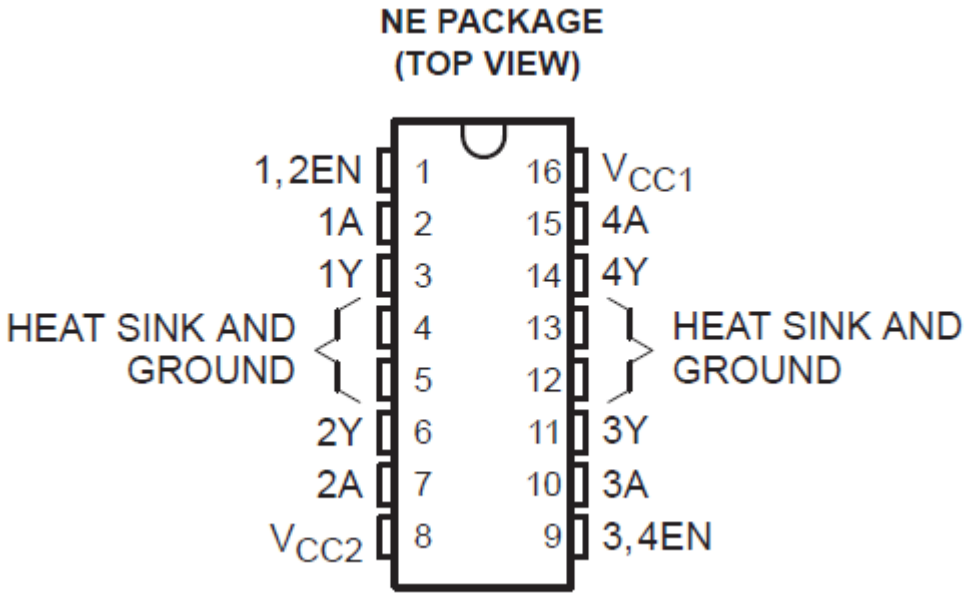
- **600-mA Output Current Capability Per Driver**
- **Pulsed Current 1.2-A Per Driver**
- **Output Clamp Diodes for Inductive Transient Suppression**
- **Wide Supply Voltage Range 4.5 V to 36 V**
- **Separate Input-Logic Supply**
- **Thermal Shutdown**
- **Internal ESD Protection**
- **High-Noise-Immunity Inputs**
- **Functional Replacement for SGS L293D**

DESCRIPTION

The L293D is a quadruple high-current half-H driver designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. It is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL-compatible. Each output is a complete totem-pole drive circuit with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs with drivers 1 and 2 enabled by 1,2EN and

drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. External

high-speed output clamp diodes should be used for inductive transient suppression. When the enable input is low, those drivers are disabled, and their outputs are off and in a high-impedance state. With the proper data inputs, each pair of drivers form a full-H (or bridge) reversible drive suitable for solenoid or motor applications. A VCC1 terminal, separate from VCC2, is provided for the logic inputs to minimize device power dissipation. The L293D is designed for operation from 0°C to 70°C.

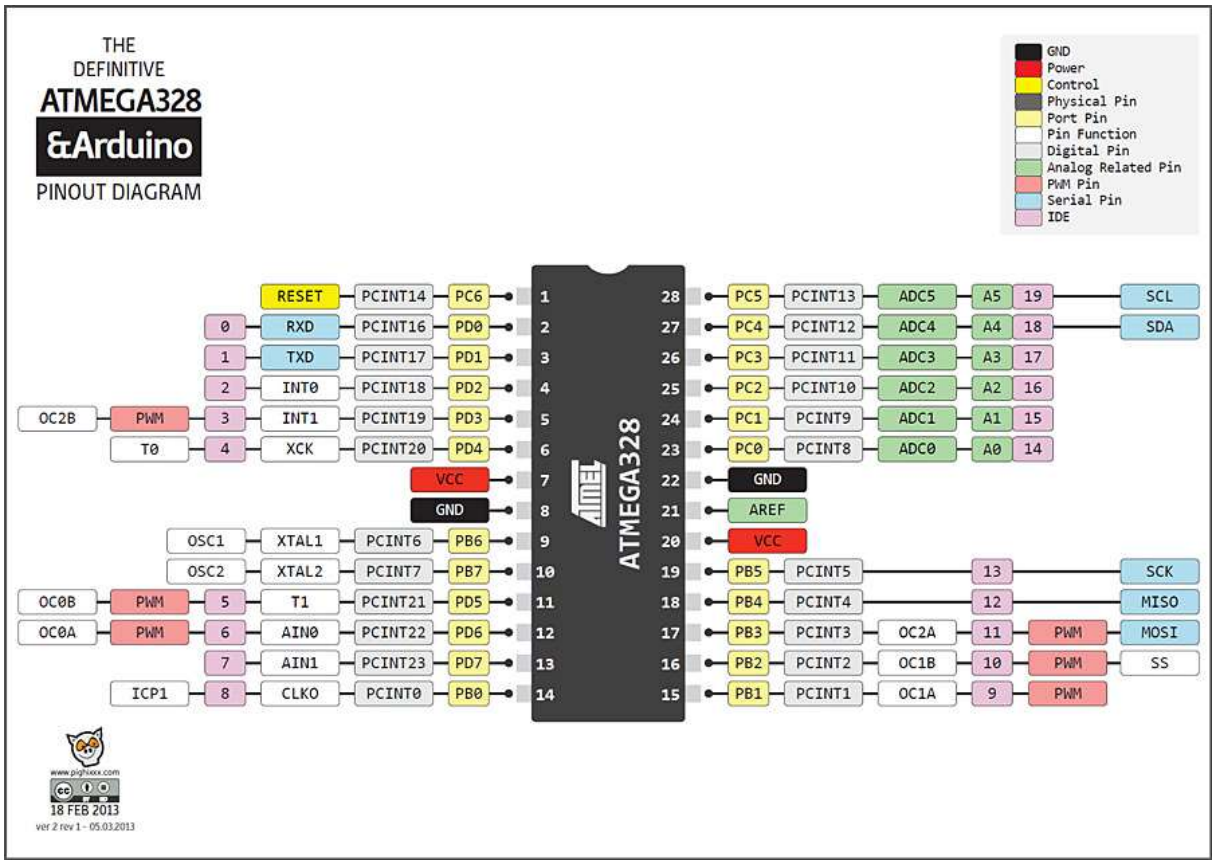


ARDUINO(ATMEGA 328)-

- High Performance,
- Low Power Atmel®AVR® 8-Bit Microcontroller Familyλ
- Advanced RISC Architectureλ–131
- Powerful Instructions –
- Most Single Clock Cycle Execution–
- 32 x 8 General Purpose Working Registers–
- Fully Static Operation–
- Up to 20 MIPS Throughput at 20MHz–
- On-chip 2-cycle Multiplier High Endurance Non-volatile Memory Segmentsλ–

- 4/8/16/32KBytes of In-System Self-Programmable Flash program memory–
- 256/512/512/1KBytes EEPROM–
- 512/1K/1K/2KBytes Internal SRAM–
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM C(1)°C/100 years at 25°–
- Data retention: 20 years at 85–
- Optional Boot Code Section with Independent Lock Bits
- In-System Programming by On-chip Boot Programλ True Read-While-Write
- Operationλ–
- Programming Lock for Software Security Atmel® QTouch® library supportλ–
- Capacitive touch buttons, sliders and wheels–
- QTouch and QMatrix® acquisition–
- Up to 64 sense channels Peripheral Featuresλ–
- Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode–
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and
- Capture Mode–
- Real Time Counter with Separate Oscillator–
- Six PWM Channels–
- 8-channel 10-bit ADC in TQFP and QFN/MLF package Temperature
- Measurementλ–
- 6-channel 10-bit ADC in PDIP Package Temperature Measurementλ–
- Programmable Serial USART–
- Master/Slave SPI Serial Interface–Byte-oriented 2-wire Serial Interface
- (Philips I2 C compatible)–
- Programmable Watchdog Timer with Separate On-chip Oscillator–On-chip
- Analog Comparator–
- Interrupt and Wake-up on Pin Change
- Special Microcontroller Features–
- Power-on Reset and Programmable Brown-out Detection–
- Internal Calibrated Oscillator–External and Internal Interrupt Sources–
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby I/O and Packagesλ–
- 23 Programmable I/O Lines–
- 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF
- Operating Voltage:λ–1.8 - 5.5V
- Temperature Range:λ C°C to 85°-40

- Speed Grade:λ–0 - 4MHz@1.8 - 5.5V, 0 - 10MHz@2.7 - 5.5.V, 0 - 20MHz @
- 4.5 - 5.5V C°
- Power Consumption at 1MHz, 1.8V, 25λ–
- Active Mode: 0.2mA–Power-down Mode: 0.1µA–
- Power-save Mode: 0.75µA (Including 32kHz RTC)



ATMega328p is the ATMEL Microcontroller on which Arduino board is based. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB In-System Programmable Flash(ISP) memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines,32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between1.8-5.5volts. The device achieves through put approaching 1 MIPS per MHz Serial data to the MCU is clocked on the rising edge and data from the MCU is clocked on the falling edge. Power is applied to VCC while RESET and SCK are set to zero. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost microcontroller is needed.

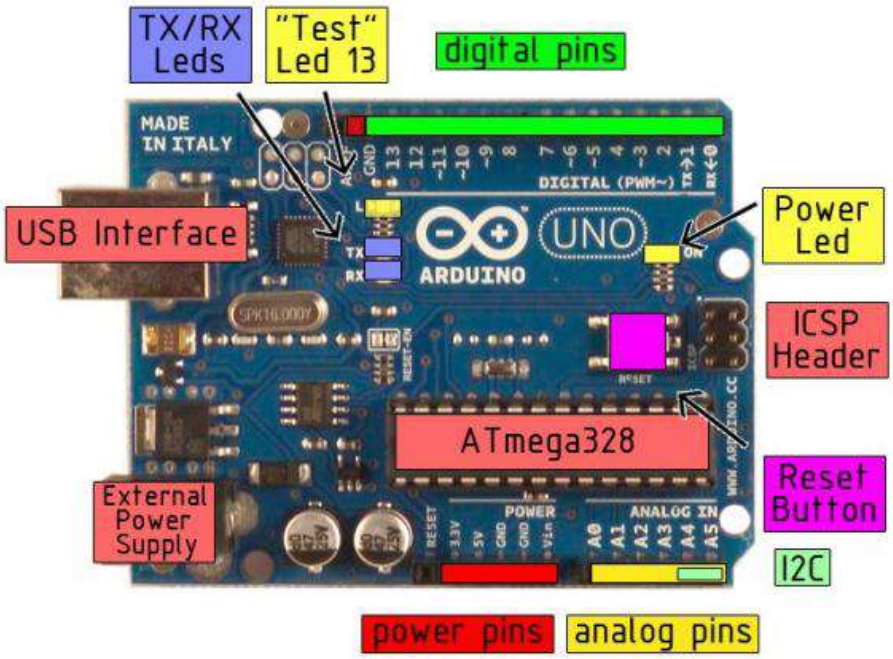
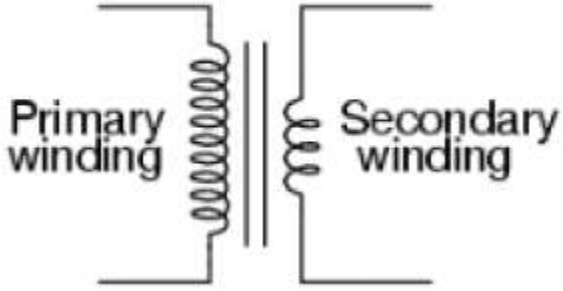


Fig -2: Arduino pin description

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

TRANSFORMER

Transformer is a major class of coils having two or more windings usually wrapped around a common core made from laminated iron sheets. It has two cols named primary and secondary. If the current flowing through primary is fluctuating, then a current will be inducted into the secondary winding. A steady current will not be transferred from one coil to other coil.



Transformers are of two types:

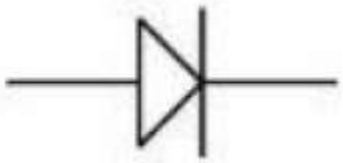
1.Step up transformer

2.Step down transformer

In the power supply we use step down transformer. We apply 220V AC on the primary of step down transformer. This transformer step down this voltages to 6V AC. We Give 6V AC to rectifier circuit, which convert it to 5V DC.

DIODE

The diode is a p-n junction device. Diode is the component used to control the flow of the current in any one direction. The diode widely works in forward bias.



Diode When the current flows from the P to N direction. Then it is in forward bias. The Zener diode is used in reverse bias function i.e. N to P direction. Visually the identification of the diode`s terminal can be done by identifying he silver/black line. The silver/black line is the negative terminal (cathode) and the other terminal is the positive terminal (cathode).

APPLICATION

•Diodes: Rectification, free-wheeling, etc

•Zener diode: Voltage control, regulator etc.

•Tunnel diode: Control the current flow, snobbier circuit, etc

RESISTORS

The flow of charge through any material encounters an opposing force similar in many respects to mechanical friction .this opposing force is called resistance of the material .in some electric circuit resistance is deliberately introduced in form of resistor. Resistor used fall in three categories , only two of which are color coded which are metal film and carbon film resistor .the third category is the wire wound type ,where value are generally printed on the vitreous paint finish of the component. Resistors are in ohms and are represented in Greek letter omega, looks as an upturned horseshoe. Most electronic circuit require resistors to make them work properly and it is obliviously important to find out something about the different types of resistors available. Resistance is measured in ohms, the symbol for ohm is an omega ohm. 1 ohm is quite small for electronics so resistances are often given in kohm and Mohm.

Resistors used in electronics can have resistances as low as 0.1 ohm or as high as 10 Mohm.

FUNCTION

Resistor restrict the flow of electric current, for example a resistor is placed in series with a light-emitting diode(LED) to limit the current passing through the LED.

TYPES OF RESISTORS

FIXED VALUE RESISTORS

It includes two types of resistors as carbon film and metal film .These two types are explained under

1. CARBON FILM RESISTORS

During manufacture, at in film of carbon is deposited onto a small ceramic rod. The resistive coating is spiraled away in an automatic machine until the resistance between there two ends of the rods is as close as possible to the correct value. Metal leads and end caps are added, the resistors is covered with an insulating coating and finally painted with colored bands to indicate the resistor value

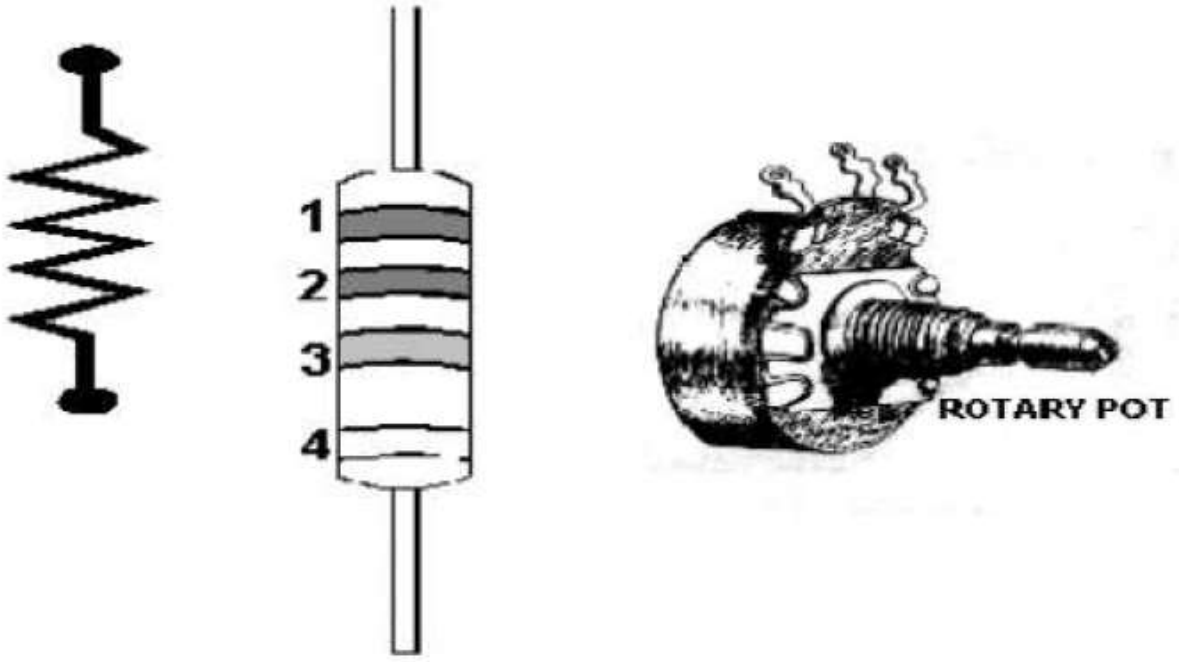


Figure No. 1.15: Carbon Film Resistors

Figure No. 1.15: Carbon Film Resistors

Another example for a Carbon 22000 Ohms or 22 Kilo-Ohms also known as 22K at 5% tolerance: Band 1 = Red, 1st digit Band 2 = Red, 2nd digit Band 3 = Orange, 3rd digit, multiply with zeros, in this case 3 zero's Band 4 = Gold, Tolerance, 5%

METAL FILM RESISTORS

Metal film and metal oxides resistors are made in a similar way, but can be made more accurately to within ±2% or ±1% of their nominal vale there are some difference in performance between these resistor types, but none which affects their use in simple circuit.

WIRE WOUND RESISTOR

A wire wound resistor is made of metal resistance wire, and because of this, they can be manufactured to precise values. Also, high wattage resistors can be made by using a thick wire material. Wire wound resistors cannot be used for high frequency circuits. Coils are used in high frequency circuit. Wire wound resistors in a ceramic case, strengthened with special cement. They have very high power rating, from 1 or 2 watts to dozens of watts. These resistors can become extremely hot when used for high power application, and this must be taken into account when designing the circuit.

TESTING

Resistors are checked with an ohm meter/millimeter. For a defective resistor the ohm-meter shows infinite high reading.

CAPACITORS

In a way, a capacitor is a little like a battery. Although they work in completely different ways, capacitors and batteries both store electrical energy. If you have read How Batteries Work , then you know that a battery has two terminals. Inside the battery, chemical reactions produce electrons on one terminal and absorb electrons at the other terminal.

BASIC

Like a battery, a capacitor has two terminals. Inside the capacitor, the terminals connect to two metal plates separated by a dielectric. The dielectric can be air, paper, plastic or anything else that does not conduct electricity and keeps the plates from touching each other. You can easily make a capacitor from two pieces of aluminum foil and a piece of paper. It won't be a particularly good capacitor in terms of its storage capacity, but it will work.

In an electronic circuit, a capacitor is shown like this:

Figure No. 1.17: Symbol of Capacitor

When you connect a capacitor to a battery, here's what happens:

•The plate on the capacitor that attaches to the negative terminal of the battery accepts electrons that the battery is producing.

•The plate on the capacitor that attaches to the positive terminal of the battery loses electrons to the battery.

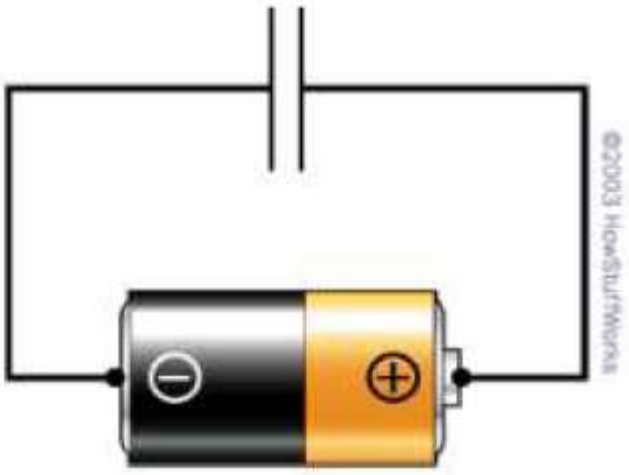


Figure No. 1.18: Capacitor & Battery Connection

TESTING

To test the capacitors, either analog meters or specia

l digital meters with the specified function are used. The non-electrolyte capacitor

can be tested by using the digital meter.
Multi – meter mode : Continuity Positive probe : One end Negative probe : Second end Display : `0`(beep sound occur) `OL` Result : Faulty OK

LED

LED falls within the family of P-N junction devices. The light emitting diode (LED) is a diode that will give off visible light when it is energized. In any forward biased P-N junction there is, with in the structure and primarily close to the junction, a recombination of hole and electrons. This recombination requires that the energy possessed by the unbound free electron be transferred to another state. The process of giving off light by applying an electrical source is called electroluminescence.

Figure No. 1.19: LED & LED Symbol

LED is a component used for indication. All the functions being carried out are displayed by led .The LED is diode which glows when the current is being flown through it in forward bias condition. The LEDs are available in the round shell and also in the flat shells. The positive leg is longer than negative leg.

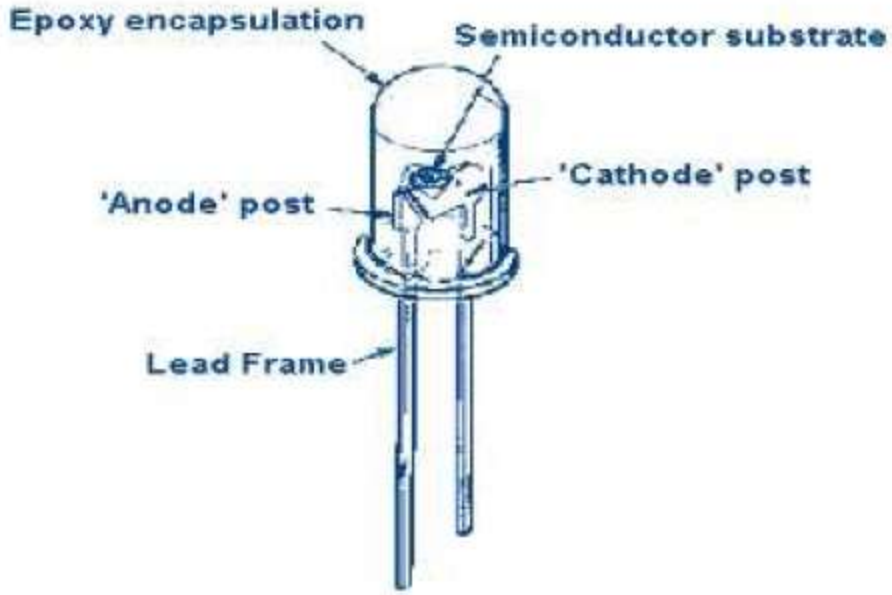


Figure No. 1.20: Detailed Diagram of LED

SERVO MOTOR

How Servo Motors Work

Servo Motors: High in Efficiency and Power

Servo motors have been around for a long time and are utilized in many applications. They are small in size but pack a big punch and are very energy-efficient. These features allow them to be used to operate remote-controlled or radio-controlled toy cars, robots and airplanes. Servo motors are also used in industrial applications, robotics, in-line manufacturing, pharmaceutics and food services. But how do the little guys work?

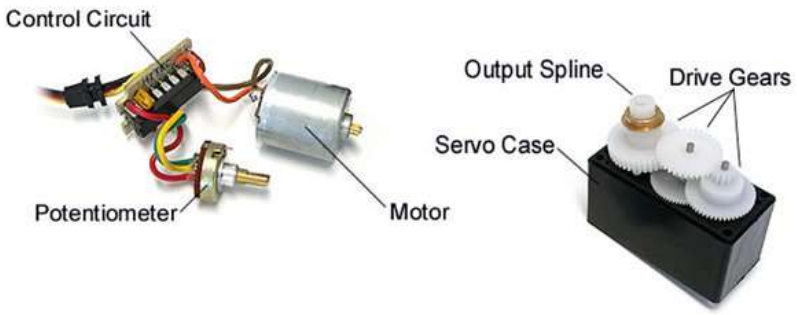
The servo circuitry is built right inside the motor unit and has a positionable shaft, which usually is fitted with a gear (as shown below). The motor is controlled with an electric signal which determines the amount of movement of the shaft.

What's inside the servo?

To fully understand how the servo works, you need to take a look under the hood. Inside there is a pretty simple set-up: a small DC motor, potentiometer, and a control circuit. The motor is attached by gears to the control wheel. As the motor rotates, the potentiometer's resistance changes, so the control circuit can precisely regulate how much movement there is and in which direction.

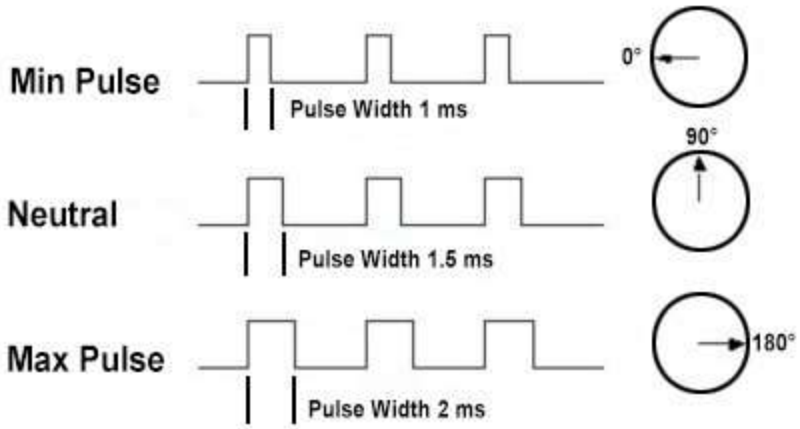
When the shaft of the motor is at the desired position, power supplied to the motor is stopped. If not, the motor is turned in the appropriate direction. The desired position is sent via electrical pulses through the signal wire. The motor's speed is proportional to the difference between its actual position and desired position. So if the motor is near the desired position, it will turn slowly, otherwise it will turn fast. This is called **proportional control.** This means the motor will only run as hard as necessary to accomplish the task at hand, a very efficient little guy.

How is the servo controlled?



The guts of a servo motor (L) and an assembled servo (R)

Servos are controlled by sending an electrical pulse of variable width, or **pulse width modulation** (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire; the rotor will turn to the desired position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position. Shorter than 1.5ms moves it in the counter clockwise direction toward the 0° position, and any longer than 1.5ms will turn the servo in a clockwise direction toward the 180° position.



Variable Pulse width control servo position

When these servos are commanded to move, they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is called the **torque rating** of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

Types of Servo Motors

There are two types of servo motors - AC and DC. AC servo can handle higher current surges and tend to be used in industrial machinery. DC servos are not designed for high current surges and are usually better suited for smaller applications. Generally speaking, DC motors are less expensive than their AC counterparts. These are also servo motors that have been built specifically for continuous rotation, making it an easy way to get your robot moving. They feature two ball bearings on the output shaft for reduced friction and easy access to the rest-point adjustment potentiometer.

Servo Motor Applications

Servos are used in radio-controlled airplanes to position control surfaces like elevators, rudders, walking a robot, or operating **grippers.** Servo motors are small, have built-in control circuitry and have good power for their size.

In food services and pharmaceuticals, the tools are designed to be used in harsher environments, where the potential for corrosion is high due to being washed at high pressures and temperatures repeatedly to maintain strict hygiene standards. Servos are also used in **in-line manufacturing**, where high repetition yet precise work is necessary.

Of course, you don't have to know how a servo works to use one, but as with most electronics, the more you understand, the more doors open for expanded projects and projects' capabilities. Whether you're a hobbyist building robots, an engineer designing industrial systems, or just constantly curious, where will servo motors take you?

What is a Servo Motor?

A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a **servo mechanism**. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the **DC servo motor working**. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the

load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Servo Motor Working Mechanism

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Here reference input signal is compared to the reference output signal and the third signal is produced by the feedback system. And this third signal acts as an input signal to the control the device. This signal is present as long as the feedback signal is generated or there is a difference between the reference input signal and reference output signal. So the main task of servomechanism is to maintain the output of a system at the desired value at presence of noises.

Servo Motor Working Principle

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

Interfacing Servo Motors with Microcontrollers:

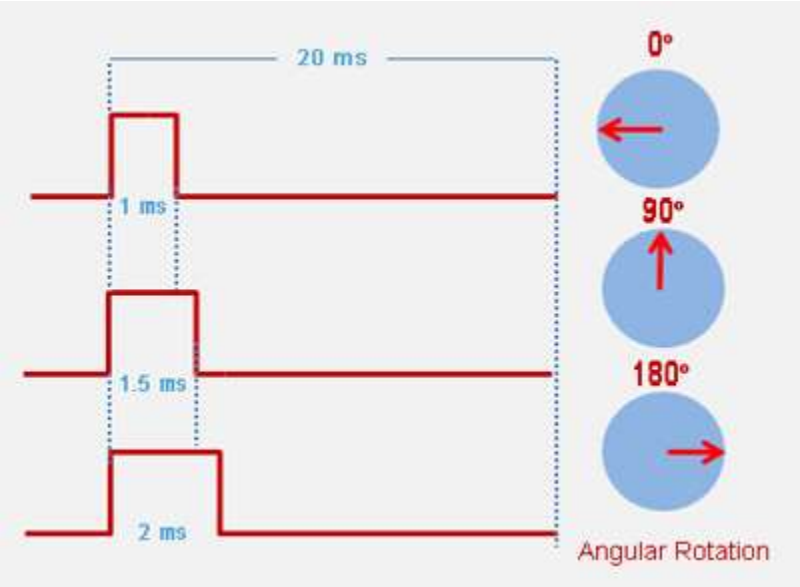
Interfacing hobby Servo motors like s90 servo motor with MCU is very easy. **Servos have three wires coming out of them**. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU. An **MG995 Metal Gear Servo**

Motor which is most commonly used for RC cars humanoid bots etc. The picture of MG995 is shown below:

The color coding of your servo motor might differ hence check for your respective datasheet.
All servo motors work directly with your +5V supply rails but we have to be careful on the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

Controlling Servo Motor:

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.
Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.
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**. High speed force of DC motor is converted into torque by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. The potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on the required angle.



Servo motor can be rotated from 0 to 180 degrees, but it can go up to 210 degrees, depending on the manufacturing. This degree of rotation can be controlled by applying the **Electrical Pulse** of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. The pulse of 1 ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2 ms pulse can rotate it to 180 degree.

All servo motors work directly with your +5V supply rails but we have to be careful about the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

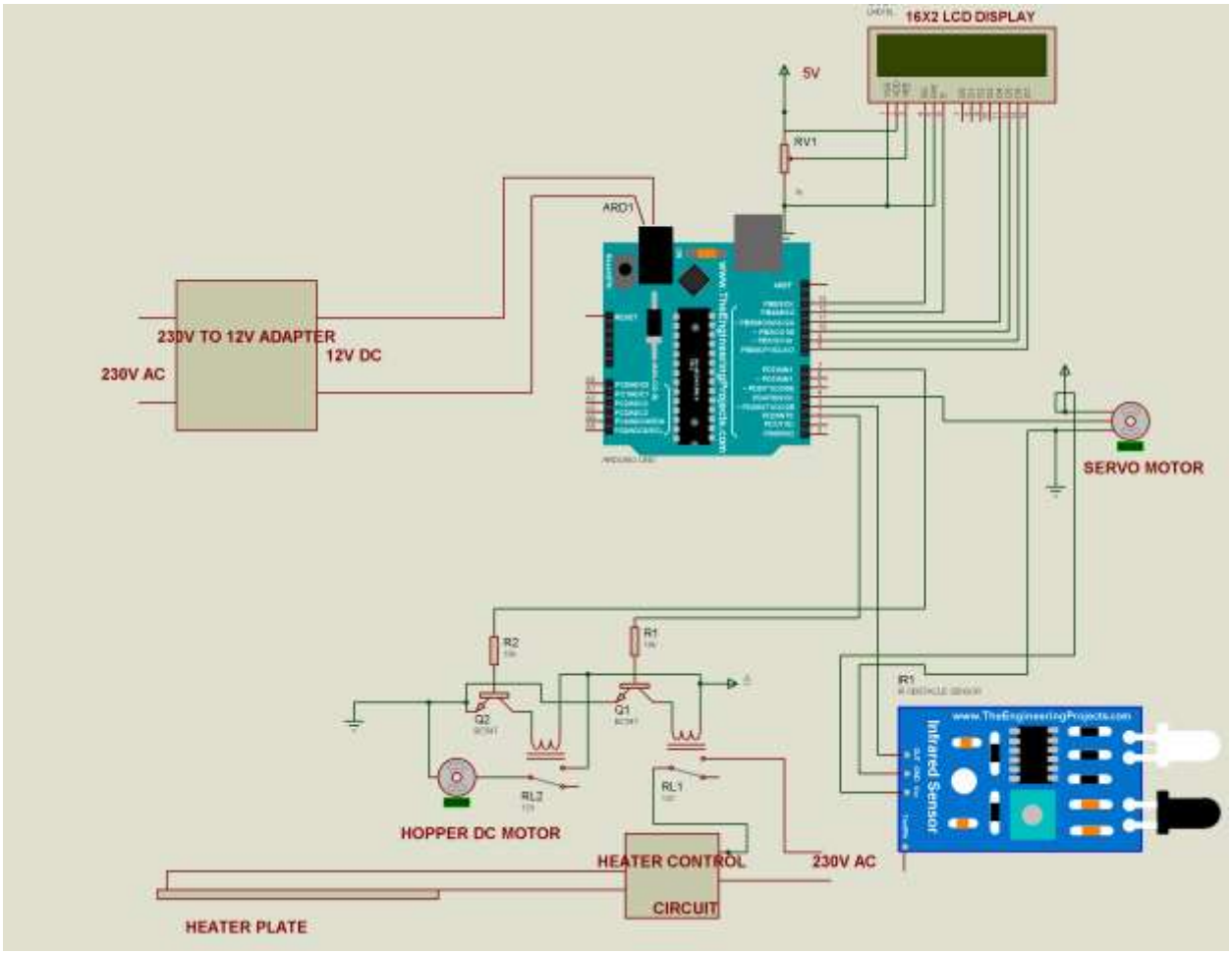
General Specifications

Pulse Width	500µs - 2400µs
Rotation/Support	Bushing
Shaft Diameter	4.5mm
Speed	0.32 oz (9.0 g)
Torque	4.8V: 25.0 oz-in (1.80 kg-cm)
Gear Type	Plastic
Modulation	Analog
Motor Type	3 Pole Servo Motor
Range	180°

Power Supply

Phase Voltage	5V

CIRCUIT DIAGRAM



PCB ARTWORK CONSTRUCTION:-

TYPES OF PCB:

1. Single sided PCB

   It has component on cane side and conductor on the other side, it is used in entertainment electronics devices where cost has to be taken minimum to jump over the track component

   Have to be utilized. If possible jumper wire wre used. The no. of jumper wire on the board are restricted by the electronic resonance. If this wires are more then use double sided PCB.

2. Double sided OCB

   It has two types

   a) With plated through holes(PTH)
   b) Without plated through holes.

Here the conductor tracks and solders pads on both sides. These PCB's are made with or without using PTH. Bores with PTH are fairly expensive.
Therefore they chose only where the ckt complexity and density doesn't have another choice. Double sided PCB without PTH is less expensive. Soldering component lead on both sides of board makes the components.

3. Multilayer PCB

   No. of PCB's are stack together with adhesive and electrical connection between different conducting layers along plate through holes.

   Advantages of multilayer PCB'S:-

   1. Multilayer high component density can be archived.
   2. Whenever scale and volume are prime importance there boards are used.
   3. Complete interconnection is possible
   4. Provides low impedence of supply.

4.Flexible PCB

In this ckts base are replaced by this insulation material like paper.

Advantages :

1) Space saving
2) Multilayer capacity.

Rules of layout:-

1. Larger components are replaced by first and between them it filled by small ones
2. Component requiring input-output connected to near to supply connection.
3. As per the component size different size of holes are taken
4. Heat source-heat producing sources or component must be marked
5. Inductive coupling-when PCB's are used for high frequencies inductive coupling is considered
6. Capacitive coupling.

Artwork:

The generation of PCB artwork should be considered as first step of PCB manufacturing process. The importance of artwork should not be underestimated. The problem that inaccurate registration, broken annular rings or critical cpacing due to bad atwork.

General artwork rules:

1) Conductor orientation:-

   The conductor have to be placed in other direction, preference should be given, to the 45 degree direction or the 30/60 degree direction. The strict observation of this rule helps in an optimum utilization of the space available and gives well-organized appricience.

2) Conductor routing practice:-

   It is good to begin and end the conductor in another pad. In certain cases, however, where this wiil be increase the length of the conductor, it can also terminated by joining another conductor. Conductor forming sharp internal angles of less than 60 degrees must be avoided. This is of particular importance for boards, which have the wave solder.

3) When specifying the minimum spacing requirement, there are various factors, which have to be kept in view. The yield in PCB fabrication will otherwisecome down with minimum spacing.

Etching:-

In all subtractive PCB processes, eatching is one of the most important steps. The final copper pattern is formed by selective removal of all unwanted copper, which not protected by an etch resist, the PCB developed for etching process the deposited west or other acid resistance material over designed that was retained thick metallic design would remain.

Process of etching:-

1. Process begins with cu coil bounded on an insulaing board material the boarding occur on electroplating operation.
2. The resist of etchant resistance material is applied to cu foil as flux of photo printing or photo emerging process. The resist material such as ink that prevents those parts of copper foil from etching away. The resist is deposited on cu coil is exact pattern of art matter.
3. After etching only protected by resist have cu foil remaining.
4. The resist of cu has been removed by washing circuit.

Drilling:-

Drilling of component mounting hole in to PCB's is by far the most important mechanical machining operation in PCB production processes. Drilling wherever a superior hole finish for plated through hole processes is required and where the tooling cost of punching tool cannot be justified makes holes. There fore drilling is applied the entire professional grades PCB manufacturers and generally in all smaller PCB production plant and laboratories. The importance of hole drilling in to the PCB has further gone up with electronic component miniaturization and its need for smaller ho,e diameter and higher oackage density where hole punching is practically ruled out.

Types of Drilling:-

1. Drilling by direct sight
2. Drilling by optical sight
3. Jig drilling
4. NC drilling.

Soldering:-

Solders are specifically alloys of which are used to get a mechanically strong joint of low contact resistance. They have low melting point as compared to

metal. A heated molten solder wets the metal spreads and joints any combination on the surface of metal to be joined.

Welding solder is divided into 2 groups:-

1. soft solder: they have low melting point lower tensile strength. Soft solder are largely tin lead alloy with 18% to19% tin.
2. Hard solder: they are cu, Zn alloys and single basic composition.

Types of soldering:

1) Iron soldering
2) Mass soldering

it is usually used In electronic industries where whole PCB assembly soldered from one side.

There are three types again:-

1. Dip soldering:

It is use in electronic industries where whole PCB assembly soldered at a time. Here PCB assembly is lowered in vertically in solder both so that one side marker contacts with solder.

2. Drag soldering:

In drag soldering PCB is created in the solder by pumping out solder through a narrow slot and the PCB side is soldered.

3. Wave soldering:

Here small solder wave is created in the solder by pumping out solder through a narrow slot and the PCB side is soldered.

TESTING PROCEDURE:

We now proceed to our next section that is testing of components.

Resistance measurement:

Fixed resistor such as carbon component metal film and wire wound type can be tasted by using ohmmeter section of Vom. Place the Vom across the resistor. When mixing iron out of the circuit diagram measurement as per figure. resistors are used as

bidirectional components will pass current in either direction polarities needed to be observed when measuring or testing.

When in measurement of resistor make the test with no volt applied the cut to prevent damage to Vom.

CHECKING PRINTED CIRCUIT BOARD:

If the circuit dose not work when it is turned on for the first time critically check the foil conductor pattern before the beginning to the rest. The component leak for short circuit that is because of solder binding between adjacent conductor turns or pass for other frequency encountered, the following errors may occur:

Interconnection wire error

Component placement error

solder joints PCB layouts error.

Incorrect tolerance of capacitor and diode.

Crack or opening in the PCB foil.

Thus with help of above procedure we can check the different electronic components.

Facilities required for proposed work

Hardware required

1) Arduino uno
2) LCD display
3) Motors
4) Heater for sealing
5) Power supply

Software required-

1) Arduino IDE
2) Proteus for PCB designing.

Applications-

Automatic power packing

Advantages-

1) Fast than manual operation.
2) Low maintenance.

3) Easy to operate.
4) Cost effective.

Refrences-

1) Automated Bottle Filling & Capping Machine using ARDUINO
Mr.Lakshmeesha, Mr.Prajwal Kotian,Mr.Shetty Ganesh, Mr.Sriganesh, Under the guidance of Prof. Ravindran K.N Alva's Institute of Engineering and Technology, Mijar, Moodbidri, Mangaluru, Karnataka
2) DESIGN AND SIMULATION OF LOW COST PACKAGING MACHINE IN SYNCHRONIZATION WITH ASSEMBLY LINE
A.P Singh, Rakesh Kumar Chaurasia Mechanical Engineering Department, IPEC Ghaziabad, INDIA
3) Volume Measuring System Using Arduino for Automatic Liquid Filling Machine
M.H. Muhammad Sidik1 and S.A. Che Ghani2 1Universiti Kuala Lumpur International College, Seksyen 14, Jalan Teras Jernang, 43650 Bandar Baru Bangi, Selangor, Malaysia. 2Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia.
4) AUTOMATED BOTTLE FILLING SYSTEM
Bipin Mashilkar[1] ,PraseedKumar[2] Amit Chawathe[3] , Vivek Dabhade[4] , Vighnesh Kamath[5] ,Gayatri Patil[6] [1], [2] Assistant Professor, Mechanical engineering department, Fr. C. R.I.T., Vashi, Navi Mumbai. [3], [4], [5], [6] Undergraduate student, Mechanical engineering department, Fr. C. R.I.T, Vashi, Navi Mumbai