A PROJECT REPORT

ON

"AUTOMATIC JOB SORTING MACHINE"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

THONGE ZAID AZIM (18DME55)

KAZI SALMAN SIRAJ (18DME34)

PETKAR MUZAMMIL ASHRAF (18DME31)

TULVE MUSTAFA M. HANIF (16ME91)

UNDER THE GUIDANCE OF
PROF. RIZWAN SHAIKH

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2020-2021

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Affiliated to Mumbai University)

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CERTIFICATE

This is to certify that the project entitled

"**AUTOMATIC JOB SORTING MACHINE**"

Submitted by

THONGE ZAID AZIM	**(18DME55)**
KAZI SALMAN SIRAJ	**(18DME34)**
PETKAR MUZAMMIL ASHRAF	**(18DME31)**
TULVE MUSTAFA M. HANIF	**(16ME91)**

To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University of Mumbai**, is approved.

Internal Examinar **External Examiner**

(Prof. **RIZWAN SHAIKH**) (Prof.)

Head of Department **Principal**

(Prof. **ZAKIR ANSARI**) (Dr. **ABDUL RAZAK HONNUTAGI**)

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APPROVAL OF DISSERTATION

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TULVE MUSTAFA M. HANIF (16ME91)

In partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering, as prescribed by University of Mumbai approved.

(Internal Examiner) **(External Examiner)**

_____ _____

Date: _____

ACKNOWLEDGEMENT

After the completion of this work, we would like to give our sincere thanks to all those who helped us to reach our goal. It's a great pleasure and moment of immense satisfaction for us to express my profound gratitude to our guide **Prof. Rizwan Shaikh** whose constant encouragement enabled us to work enthusiastically. His perpetual motivation, patience and excellent expertise in discussion during progress of the project work have benefited us to an extent, which is beyond expression.

We would also like to give our sincere thanks to **Prof. ZAKIR ANSARI** Head of Department, **Prof. Rizwan Shaikh** Project Co-Guide and **Prof Rizwan Shaikh** Project co-ordinator from Department of Mechanical Engineering, Kalsekar Technical Campus, New Panvel, for their guidance, encouragement and support during a project.

I take this opportunity to give sincere thanks to **Mr.Kadar** in "*Mechanical machine Room"* , for all the help rendered during the course of this work and their support, motivation, guidance and appreciation.

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Last but not the least I would also like to thank all the staffs of Kalsekar Technical Campus (Mechanical Engineering Department) for their valuable guidance with their interest and valuable suggestions brightened us.

THONGE ZAID AZIM
KAZI SALMAN SIRAJ
PETKAR MUZAMMIL ASHRAF
TULVE MUSTAFA M. HANIF

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

Sorting is very important in any type of industry such as manufacturing industry to improve the efficiency of manufacturing processes . Generally the manufacturing industries keep on manufacturing similar models of products with little variation in their height, color, weight and shape. Hence, sorting plays an important role there. In older days, it was possible to utilize manual labour for sorting the objects. But in the world of technology today where there are speed running industries, the production rate has increased tremendously. In such cases industries can't bear human errors for sorting these products that too associated with high labour costs and time taking procedures. This gives rise to the necessity to reduce manual effort and also human error by replacing the conventional methods of sorting in areas involving hectic sorting with cut-cost user friendly automated systems.

The goal with "Automatic Job Sorting Machine " is to create a smart prototype model in which instead of using manual inspection and sorting here we are introducing an automatic system . In this type of conveyor system , sensors (i.e Ultrasonic and Ir) are used to measure the dimensions of parts placed over it and a linear solenoid is placed next to the sensor which will separate the component based on its dimensions. By using this system, we completely eliminate manual work and reduce inspection time , effort in material handling and also increase production rate.

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CHAPTER NO 1

INTRODUCTION

CHAPTER 1 .

INTRODUCTION

1.1. INTRODUCTION :

It is well understood that manufacturing industries play a vital role in the development of any country and its economy. This is why the countries which have relatively higher manufacturing rates are known to be developed whereas those with lesser manufacturing are still underdeveloped. Hence, the development of manufacturing industries is of utmost importance and since it depends upon the innovations in the manufacturing process, it is a significant sector that calls for most effective technology to be implemented. Generally the manufacturing industries keep on manufacturing similar models of products with little variation in their height, color, weight and shape. Hence, sorting plays an important role there. In older days, it was possible to utilize manual labour for sorting the objects. But in the world of technology today where there are speed running industries, the production rate has increased tremendously. In such cases industries can't bear human errors for sorting these products that too associated with high labour costs and time taking procedures. This gives rise to the necessity to reduce manual effort and also human error by replacing the conventional methods of sorting in areas involving hectic sorting with cut-cost user friendly automated systems. The control strategy for automating the sorting process which was earlier done by manual labour involving slow, inaccurate and erroneous outputs ,is now implemented through Ardiuno Uno as a solution to all these problems .The purpose of this project is to reduce the efforts of the workers in material handling. Hence sorting machine is more practical and economical method of automation, which transfers material from one point to another and has main task of sorting components according to the sizes. The design is quite simple and of flexible use, means only conveyor belt can be used for material handling. The automatic sorting process is used to differentiate the products manufactured in an industry to further direct it towards packaging according to height and diameter without human intervention. In this project, products are compared using ultrasonic sensor and the system is based on conveyor belt model to sort the objects which are of ideal selected height and diameter as described.

1.2. PROBLEM DEFINITION:

a. Generally the manufacturing industries keep on manufacturing similar models of products with little variation in their height, color, weight and shape. Hence, sorting plays an important role there.
b. In such cases industries can't bear human errors for sorting these products that too associated with high labour costs and time taking procedures. This gives rise to the necessity to reduce manual effort and also human error by replacing the conventional methods of sorting in areas involving hectic sorting with cut-cost user friendly automated systems.

1.3. OBJECTIVE OF THE PROJECT :

To design and fabricate a prototype of a smart material handling conveyor which is capable of sorting of the product based on it dimension to further direct it towards packaging.

1.4. PROJECT SCOPE:

Basically ,this project is to achieve the objective.
1. Focus on implementing automation in industrial field.
2. Focus on reducing labours.
3 .Focus on making low cost machine for material inspection.

CHAPTER NO 2

LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

2.1. LITERATURE SURVEY :

I.	
Title	Automatic Sorting In Process Industries Using PLC
Author	R. Aravind , M . Arun Kumar
Publication	International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 04 | Apr 2019 p-ISSN: 2395-0072
Abstract	This system comprises of two conveyors for sorting. Both the conveyors are perpendicular to each other. Sorting is based on the height of object. The object will be sensed and moved forward on the next conveyor. Then the sorting will be done by forward or reverse movement of conveyor.

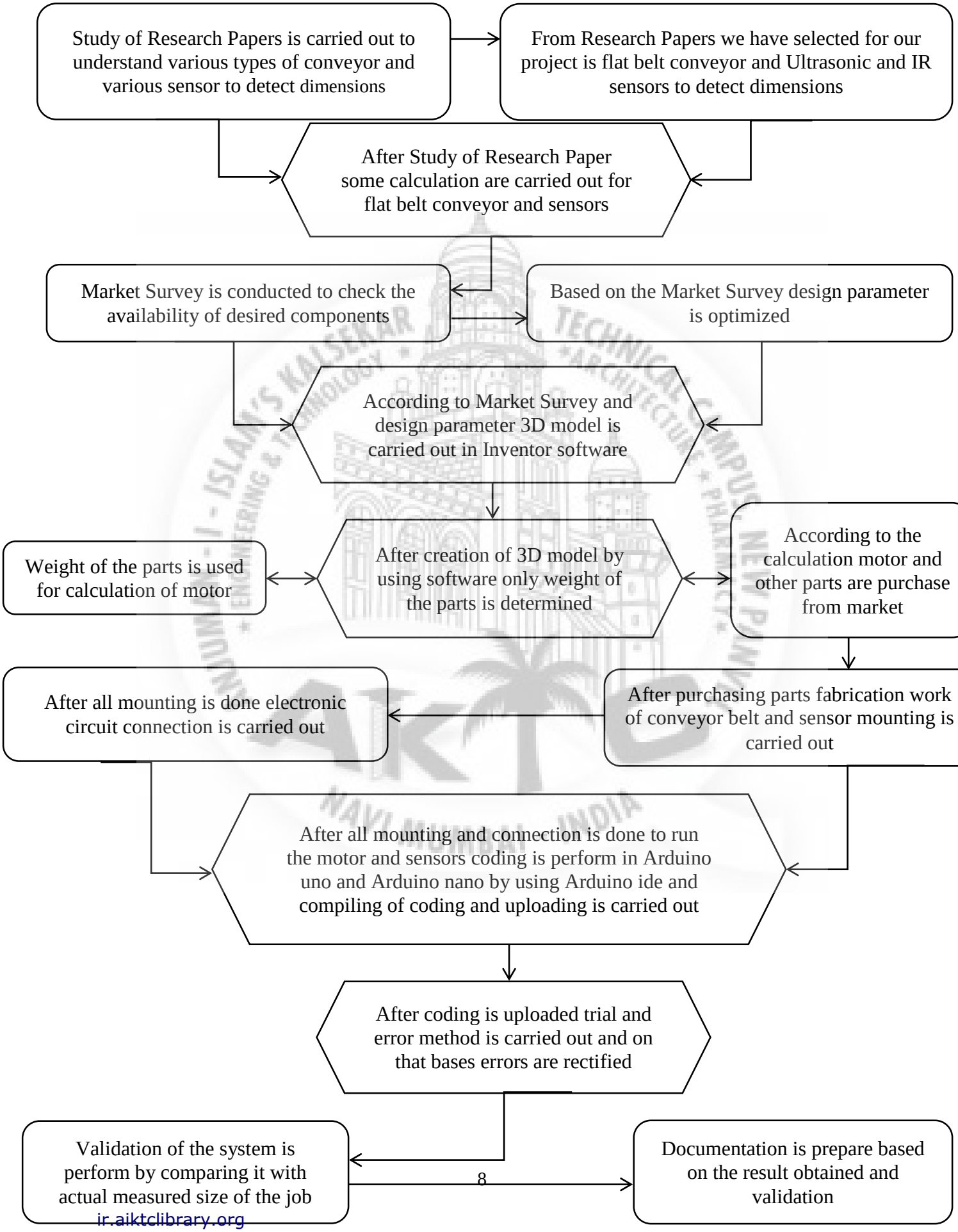
II.	
Title	Model design and simulation of automatic sorting machine using proximity sensor
Author	IA Daniyan , EsosoAghor , Asanta P. Simeon .
Publication	Engineering Science and Technology, an International Journal 19 (2016) p-ISSN: 1452–1456
Abstract	This paper deals with separating species of non- ferrous objects and at the same time moving objects automatically to the basket as defined by the regulation of the Programmable Logic Controllers (PLC) with a capacitive proximity sensor to detect a value range of objects. Each object has been sorted correctly into the designated compartment with an average sorting time of 9.9, 14.1 and 18.5 seconds for plastic, wood and steel objects respectively .The authors conclude that PLC is the 'brain' of the sorting system to executes the programmed functions.

I.	
Title	Design A Conveyor Based On Size And Color Detection Separation Of Product Using Arduino
Author	Jyothi H S, Harsha B K
Publication	International Journal of Creative Research Thoughts (IJCRT) Volume 5, Issue | 4 December 2017 p-ISSN : 2320-2882
Abstract	They have proposed an design a conveyor based on size and color detection separation of product using arduino ". They have proposed andesign includes Hardware components such as Arduino microcontroller, Power adopter, Motor driver, DC Motors, Conveyor belt, IR sensors, Color sensors, and Zigbee Radio frequency modules, PC. Software toolsthat proposed project uses are Arduino UNO, Labview, XCTU. The working mechanism goes like this. The controller which is centered between various sensors keeps on receiving data from both color sensor and obstacle sensor continuously. Depending on the frequency received from the color sensor controller decides the particular color. Objects are kept moving on the conveyor belt associated with three Obstacle sensors IR1, IR2 and IR3. When IR1is high, the object detected is smaller, when both IR1 and IR2 reach high then the object detected is larger. Once the object passes near third sensor IR3, the controller gives input to the motor to run in either clockwise or anticlockwise direction to collect larger objects at left side and smaller objects at right side. The following project is implemented to separate two colors such as green and white. Once the green is detected, M1 takes control conversely when white object is detected M2 takes control to move the objects in their respective slots. The operation of the conveyor is being monitored on Lab view using zigbee wireless communication. Controller transmits the data from zigbee transmitter to zigbee receiver, the received packets on com port are read through VISA resource and able to monitor the process on Labview front panel from the distant away from the Operating field .

CHAPTER NO 3

METHODOLOGY

CHAPTER 3. METHODOLOGY



CHAPTER NO 4 .

DESIGN AND CALCULATIONS

CHAPTER 4 .

DESIGN AND CALCULATIONS

4.1 INTRODUCTION :

This chapter consists of conveyor calculations , Motor calculation , assembly drawings and part drawings of the main components of the Automatic Job sorting conveyor system .The drawings are designed using Autodesk Inventor to generate the 2D and 3D models of the system and its components.

4.2 CONVEYOR CALCULATIONS :

Assumptions :
Centre to centre distance between two rollers (C) = 600 mm.
Diameter of roller (D) = 30mm
Width of the belt of conveyor (B) = 100 mm

1. Roller Calculation :

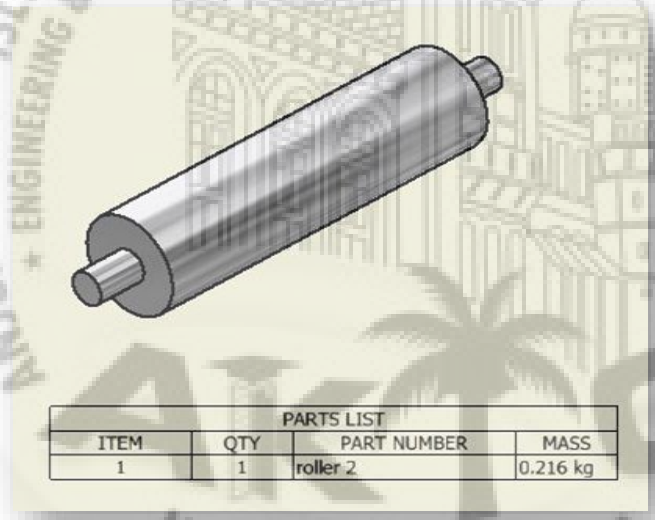


Fig4.1 Roller Calculation

a) Selecting Material of Roller : Mild Steel

b) Based upon the width of the belt of conveyor we know that , width of the roller of the conveyor (W) is given by ,

$$W = B + 2 \text{ X Edge clearance}$$

Therefore , Taking edge clearance = 5mm , so that belt remains above the rollers

$$W = 100+5x(2)$$

$$W = 110 \text{ mm}$$

c) Therefore , from the inventor software by assigning the material to the designed part we determined its weight (W_R)

$W_R = 0.216$ kg

2. Belt

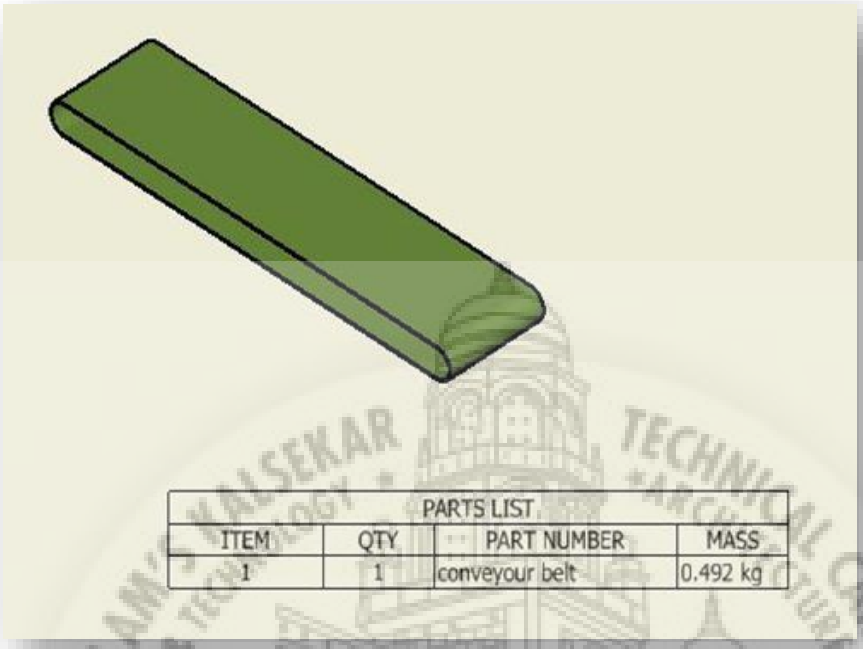


Fig4.2 Belt Calculation

Calculations :

a) Selecting Material of belt for conveyor :

b) Based upon the above assumptions and from Psg 7.53 , Length of open belt (L) is given by ,

$$L = 2\,X\,C + \frac{\pi}{2}(D + d) + \frac{(D - d)^2}{4c}$$

Where , D = d , as both rollers are of equal diameter

Therefore , D = d = 30 mm

$$\therefore\ L = 2\,X\,600 + \frac{\pi}{2}(30 + 30) + \frac{(30 - 30)^2}{4\,X\,600}$$

$$\therefore\ L = 1294.247 \text{ mm}$$

c) Therefore , from the inventor software by assigning the material to the designed part i.e Conveyor Belt we determined its weight (W_B)

$W_B = 0.492$ kg

4.3 MOTOR CALCULATION :

Power can be calculated when we know how fast and how far we need to lift the load. In other words we need to decide the speed at which we need to lift the load and the we can calculate power

We Know:-

Total Mass = Weight of Rollers + Weight of belt + Weight of Coupler + Weight of Job

= 0.216 X 2 + 0.492 + + 1

Therefore Total Mass = 2 kg

Assuming Velocity of the required system = 0.1 m/s

We know that , Acceleration due to gravity i.e 9.8 m/s^2 = 10 m/s^2

solution :-

Step1:-Power = F x V ….. (1)

step2:-Force = m x a ….. (2)

= 2 x 10

= 20 N

Step3:-Substitute the value of F in equation 1

Power = 20 x 0.1

= 2 watts

Step4:-V= πDN/60

0.1= πx30x10-3xN/60

N = 63.66 rpm

Step4:-Power = 2πNT/60

2 = 2πx63.66xT/60

T = 0.3 N-m

Torque = 3.33 kg-cm

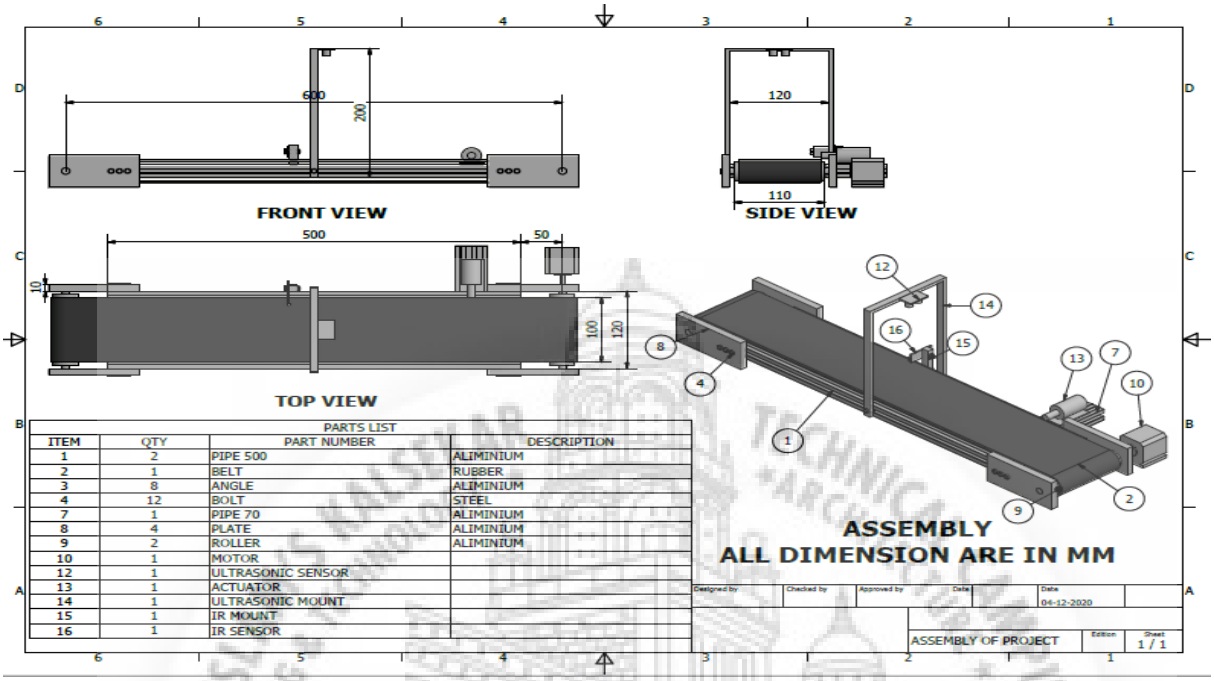
Hence we have selected standard stepper motor from market which specification is given below:-

Stepper motor specification:- Torque = 4 kg-cm

Power = 15.6 watts

4.4 ASSEMBLY AND PART DRAWING

1. Assembly Of Project :



PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	PIPE 500	ALIMINIUM
2	1	BELT	RUBBER
3	8	ANGLE	ALIMINIUM
4	12	BOLT	STEEL
7	1	PIPE 70	ALIMINIUM
8	4	PLATE	ALIMINIUM
9	2	ROLLER	ALIMINIUM
10	1	MOTOR	
12	1	ULTRASONIC SENSOR	
13	1	ACTUATOR	
14	1	ULTRASONIC MOUNT	
15	1	IR MOUNT	
16	1	IR SENSOR	

Fig4.4.1. Assembly Of Project

2. Detail Parts Of Project :

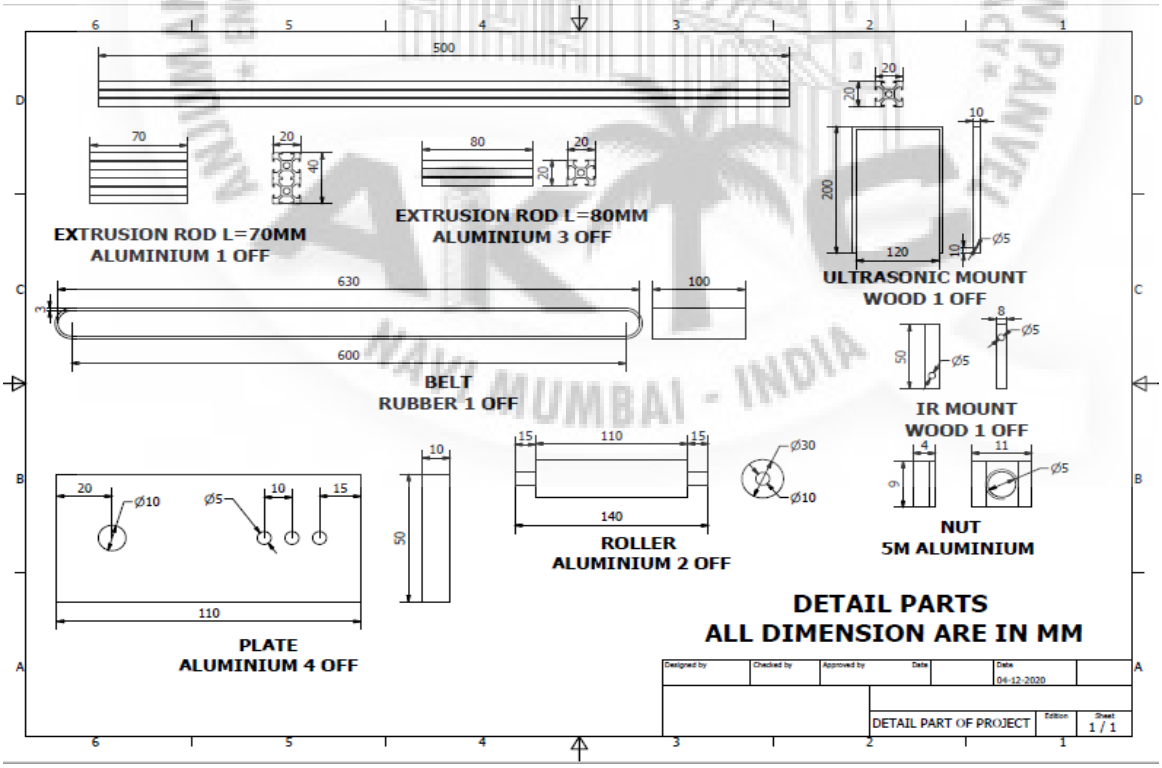


Fig4.4.2. Detail Of Project

CHAPTER NO 5

FABRICATION

CHAPTER 5

FABRICATION

5.1 MANUFACTURING.

From the various sketches, and 3D models which we have prepared, now we are ready to move on to the next stage that is Manufacturing. In order to Manufacture we require to create different Products and finally Combine it to get Final Assembly of Automatic Job Sorting Machine.

5.2 DIFFERENT PRODUCTS & TOOLS MANUFACTURED / USED FOR FABRICATION OF AUTOMATIC JOB SORTING MACHINE.

1)HORIZONTAL BEAM: -

These are primary of primary structure of the conveyor on which roller is to mounted. This aluminum extrusion is the horizontal side of the structure.

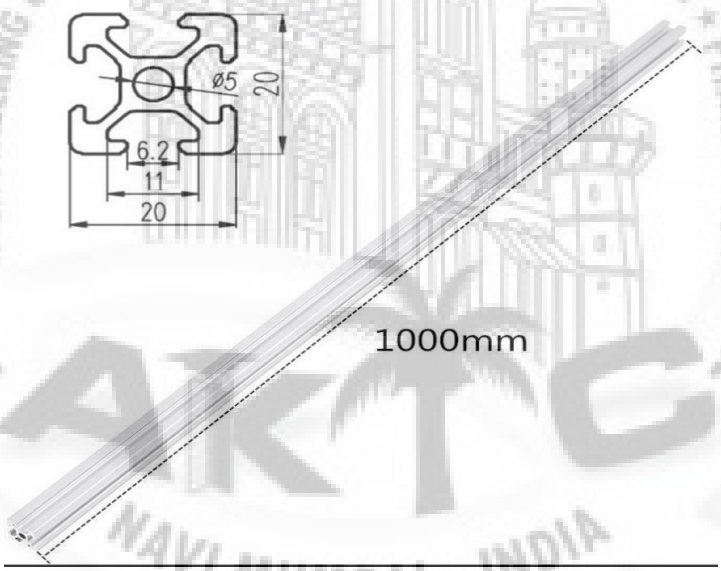


Figure 5.2.1.: 500mm x 20mm x 20mm 6063-T5 Aluminium V-Slot Z-axis Extrusion

- Material: - 6063-T5 Aluminum
- Quantity: - 2
- Profile: - 20mm x 20mm V-Slot
- Total Length: - 1000mm

2)SUPPORT COLUMN: -

This are the support column of horizontal beam. These extrusions are used to hold the beam rigidly together at same distance.

Figure 5.2.2: 80mm x 20mm x 60mm 6063-T5 Aluminium V-Slot Gantry Main Beam

- Material: - 6063-T5 Aluminum
- Quantity: - 80mm x 3
- Profile: - 20mm x 20mm V-Slot
- Total Length: - 240mm

3)VERTICAL COLUMN: -

These extrusions are the stand of the Structure. The conveyor structure stands on this column.

Figure 5.2.3: 1500mm x 20mm x 40mm 6063-T5 Aluminum V-Slot Track Extrusion

- Material: - 6063-T5 Aluminum
- Quantity: - 200mm x 4

- Profile: - 20mm x 40mm V-Slot
- Total Length: - 800mm

4) ROLLER: -

These are the main component of the structures. These are used to roll the belt and preform the function transferring the component

Figure 5.2.4 Roller

- Material: - Mild Steel
- Quantity: - 2
- Length: - 130mm
- Weight: -0.280 kg

5) SIDE PLATE WITH BEARING: -

These are used to hold the roller. These are the structure are used the circular motion of the roller.

Figure 5.2.5 Side plate with Bearing

- Material: - Mild Steel
- Quantity: - 4
- Length: - 100mm

6)COUPLER: -

These are used to attach the Motor Shaft to the Roller Shaft.

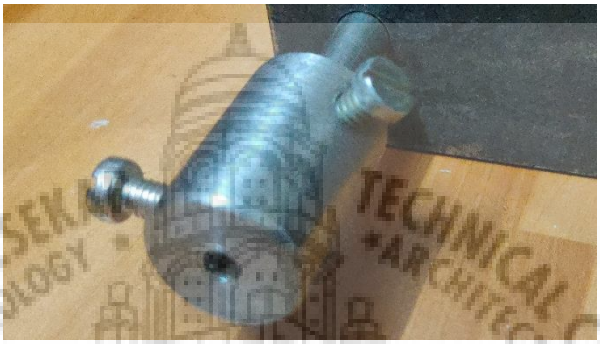


Figure 5.2.6 Coupler

- Material: - Mild Steel
- Quantity: - 1
- Length: - 35mm
- Weight: - 0.11 kg

7)BRACKET: -

These are used as attach the extrusion and form the structure of the frame. For these L-Angles are cut into pieces of 20mm equal length and holes are drilled on both the ends for fitting.

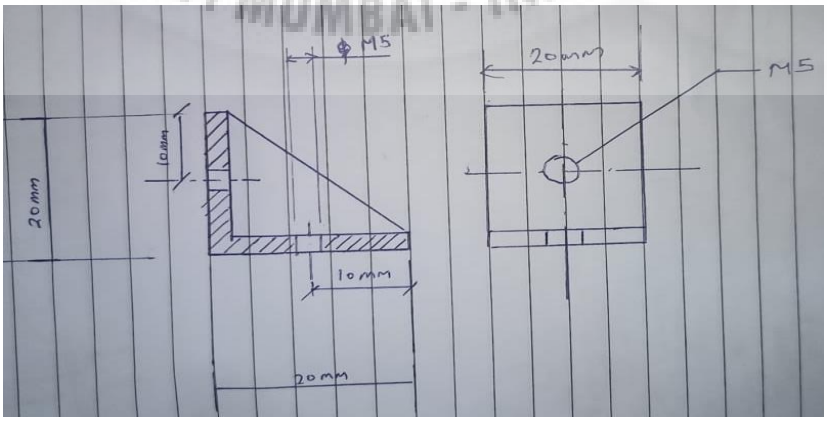


Figure 5.2.7 Bracket

- Material: - Aluminum
- Quantity: - 12
- Length: - 20mm

5.3 CONSTRUCTION OF AUTOMATIC JOB SORTING MACINE

5.3.1 FRAME CONSTRUCTION

We began our project by cutting the aluminum extrusion of profile 20mm x 20mm V-Slot of 1000mm into two equal lengths of 500mm for the horizontal base as per design of the Project. Then performing the filling operation at both the ends of extrusion for removing the burr and irregularities. After that, we took the aluminum extrusion of profile 20mm x 60mm V-Slot of 240mm length and cut into three equal pieces of 80mm and similarly perform the filling operation for it like the previous one.
After that using the 5mm metric Bolts and the T-Nuts (special Nuts for aluminum extrusion rod) we fit the extrusion as per required specification/Design. Washer was used to provide the additional grip and strength.

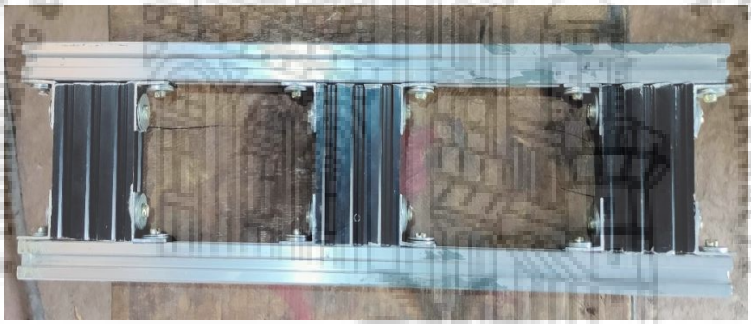


Figure 5.3.1: Construction of Frame

5.3.2 SIDE PLATE

For making the side plate, we took the metal plate of 100 mm length and counter bore the hole of the 22mm (outer diameter of Bearing) up to 10 mm length of 10mm (i.e. Thickness of Bearing) and so drilled the through holes of 8mm (i.e. Bearing internal diameter and roller Shaft Diameter) and also three holes mounting of side plates on horizontal beam of the frames

Figure 5.3.3: Construction of side plate

5.3.3 ROLLER

For making the roller, we took the Hollow Shaft of 30mm diameter and cut it into two pieces of equal length 80mm and for the roller shaft we took the solid shaft of 8mm cut it in to length of 130mm and 150mm respectively (Two different shafting since one is used for mounting of Coupling). Bushing is provided on both the end which is welded for attachment of roller and roller shaft.

Figure 5.3.3: Construction of Roller

5.3.4 COUPLING

For making the Coupler, we took 22mm solid shaft having length of 35 mm and drilled holes 5mm length at the centre. Then we Counter bore a hole of 8mm up to half of its length. Then we drilled a tapped holes of 5mm at both side for inserting the bolt of 5mm for holding the shaft of motor and Roller Shaft .

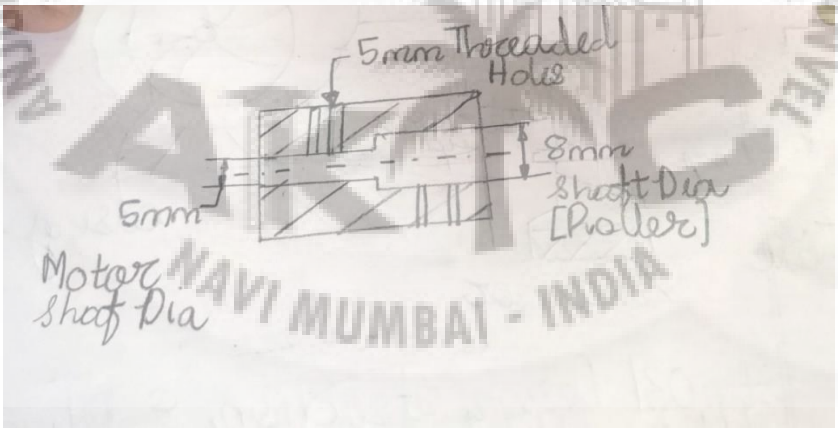
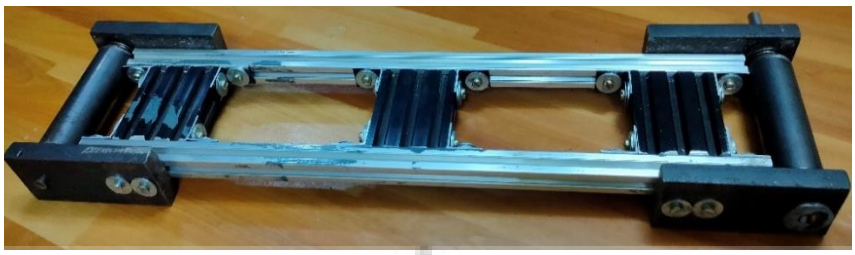


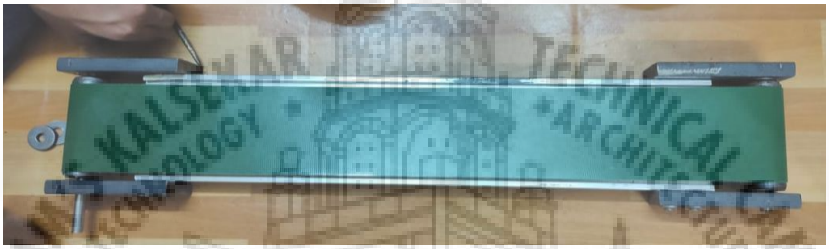
Figure 5.3.3: Construction of Coupling

5.4 FITTING OF ALL COMPONENT

1. After the completions of all the Component and structure, we mounted the side with bearing on the plate.



2.Then the roller is mounted on the frame



3.After that belt is mounted

4.Then the coupler is fitted.

CHAPTER NO 6

ELECTRONIC SYSTEM

CHAPTER 6

ELECTRONIC SYSTEM

1. Power Supply:-

12V power supplies (or 12VDC power supplies) are one of the most common power supplies in use today. In general, a 12VDC output is obtained from a 120VAC or 240VAC input using a combination of transformers, diodes and transistors. 12V power supplies can be of two types: 12V regulated power supplies, and 12V unregulated power supplies.12V regulated power supplies come in three styles: Switching regulated AC to DC, Linear regulated AC to DC, and Switching regulated DC to DC.
Power Supply unit (AKSHA) is the main supply for whole Programming unit. it takes 240V, 9A electric supply and gives 12V, 5A as output supply which can be given to other Electronic components. this is done in order to avoid fluctuations in Electric supply and to prevent other equipment's from damage.

Figure 6.1.1: Power Supply Unit

Specifications:-

- Input:- 240V-/1.9.0 9A/ 50-60Hz
- Output:- 12V-/ 5A

2. Arduino UNO: -

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software.
The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.[2][3] The board is

equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.
The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.
It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo.

➢ General pin functions:-

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

➢ Special pin functions:-

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite () function.
- **SPI** (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) : pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog inputs

The Hardware : Arduino UNO

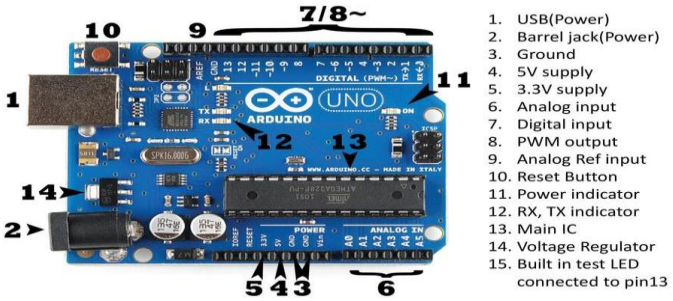


Figure 6.1.2: Arduino UNO

Specifications:-

- Input: - 7-12V
- Clock Speed: - 16 MHz

3. Arduino Nano:-

- Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).
- Arduino Nano is simply a smaller version of Arduino UNO, thus both has almost same functionalities.
- It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.
- Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.
- Each of these Digital & Analog Pins are assigned with multiple functions but their main function is to be configured as input or output.
- They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output.
- Functions like pinMode() and digitalWrite() are used to control the operations of digital pins while analogRead() is used to control analog pins.
- The analog pins come with a total resolution of 10bits which measure the value from zero to 5V.
- Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage.
- There is one limitation using Arduino Nano i.e. it doesn't come with DC power jack, means you can not supply external power source through a battery.
- This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support.
- Tiny size and breadboard friendly nature make this device an ideal choice for most of the applications where a size of the electronic components are of great concern.
- Flash memory is 16KB or 32KB that all depends on the Atmega board i.e Atmega168 comes with 16KB of flash memory while Atmega328 comes with a flash memory of 32KB. Flash memory is used for storing code. The 2KB of memory out of total flash memory is used for a bootloader.
- It is programmed using Arduino IDE which is an Integrated Development Environment that runs both offline and online.
- No prior arrangements are required to run the board. All you need is board, mini USB cable and Arduino IDE software installed on the computer. USB cable is used to transfer the program from computer to the board.

- No separate burner is required to compile and burn the program as this board comes with a built-in boot-loader.

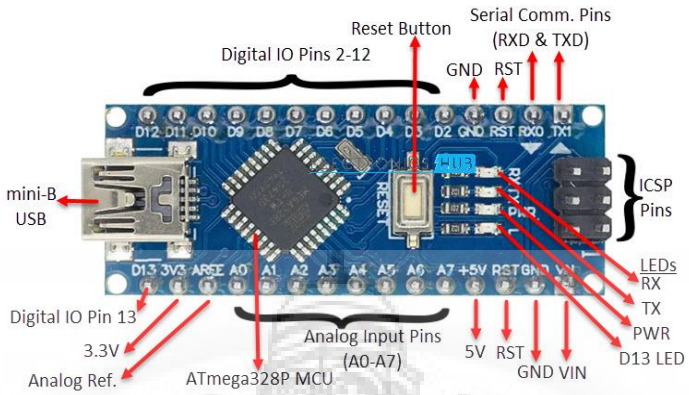


Figure 6.1.3: Arduino Nano

Specifications:-

- Microcontroller ATmega328.
- Operating Voltage (logic level): 5 V.
- Input Voltage (recommended): 7-12 V.
- Input Voltage (limits): 6-20 V.
- Digital I/O Pins : 14 (of which 6 provide PWM output)
- Analog Input Pins: 8.
- DC Current per I/O Pin: 40 mA.

4. Stepper Driver:-

The L298N is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage , high current dual full-bridge driver de-signed to accept standard TTL logic level sand drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the in-put signals .The emitters of the lower transistors of each bridge are connected together rand the corresponding external terminal can be used for the connection of an external sensing resistor. An additional Supply input is provided so that the logic works at a lower voltage.

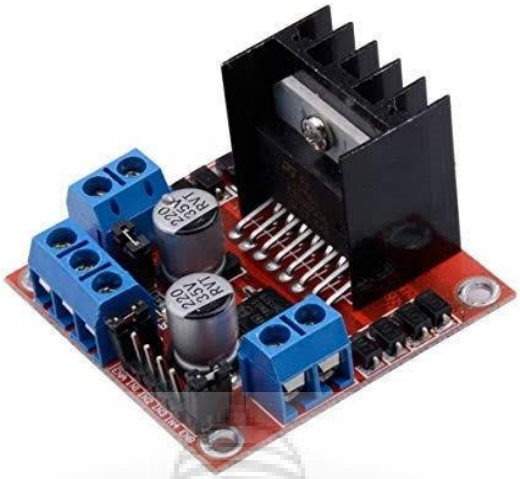


Figure 6.1.4: Stepper Driver

Specifications:-

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance

5. Ultrasonic sensor:-

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver.

The sensor works with the formula that Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

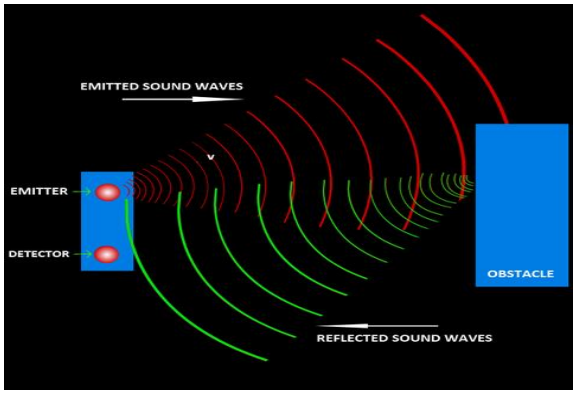


Figure 6.1.5.1: Ultra-Sonic Sensor

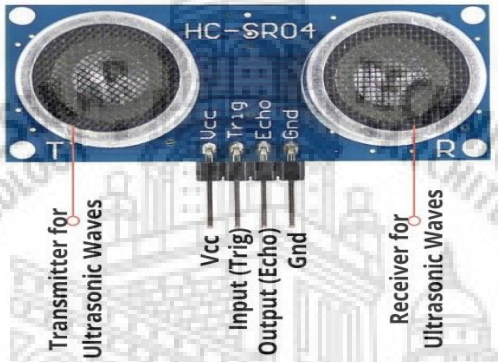


Figure 6.1.5.2: Ultra-Sonic Sensor

Specifications:-

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

6. Infrared Sensor:-

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

The emitter is simply an IR LED (Light Emitting Diode) and the detector is the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal

processing. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources.

simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by

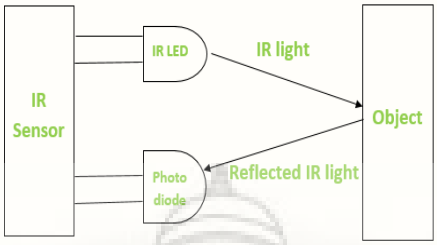


Figure 6.1.6.1: Infrared Sensor

The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received.

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor defines.

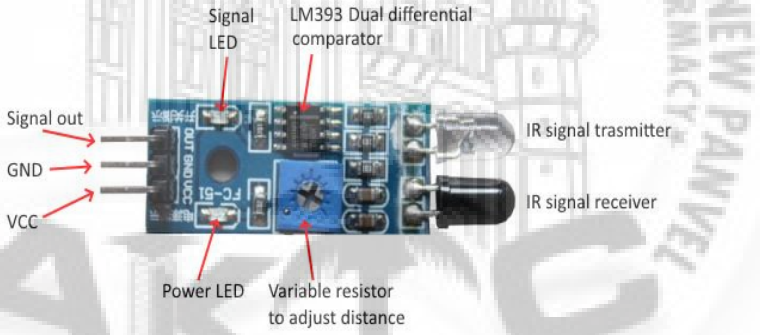


Figure 6.1.6.2: Infrared Sensor

Specifications:-

- 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

7. NEMA 17 Stepper Motor:-

This hybrid stepping motor has a 1.8° step angle (200 steps/revolution). Each phase draws 1.2 A at 4 V, allowing for a holding torque of 3.2 kg-cm (44 oz-in). The motor has six color-coded wires terminated with bare leads that allow it to be controlled by both unipolar and bipolar stepper motor drivers. When used with a unipolar stepper motor driver, all six leads are used. When used with a bipolar stepper motor driver, the center-tap yellow and white wires can be left disconnected (the red-blue pair gives access to one coil and the black-green pair gives access to the other coil). We recommend using it as a bipolar stepper motor and controlling it with one of our bipolar stepper motor drivers or one of our Tic Stepper Motor Controllers. In particular, the Tics make control easy because they support six different interfaces (USB, TTL serial, I²C, RC, analog voltages, and quadrature encoder) and are configurable over USB with our free configuration utility.

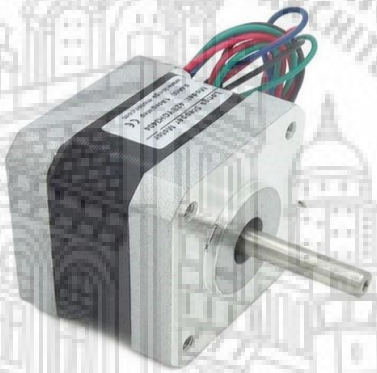


Figure 6.1.7: Nema 17 Stepper Motor

Specifications:-

- Size: 42.3 mm square × 48 mm, not including the shaft (NEMA 17)
- Weight: 350 g (13 oz)
- Shaft diameter: 5 mm “D”
- Steps per revolution: 200
- Current rating: 1.2 A per coil
- Voltage rating: 4 V
- Resistance: 3.3 Ω per coil
- Holding torque: 3.2 kg-cm (44 oz-in)
- Inductance: 2.8 mH per coil
- Lead length: 30 cm (12″)

8. Relay Module:-

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.
A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.
When electrical current is passed through a coil, it generates a magnetic field that in turn activates the armature. This movement of the movable contacts makes or breaks a connection with the fixed contact. When the relay is de-energized, the sets of contacts that were closed, open and breaks the connection and vice versa if the contacts were open. When switching off the current to the coil, the armature is returned, by force, to its relaxed position

Figure 6.1.8: Relay Module

Specifications:-

- Relay Module; Model : JQC-3FF-S-Z, 2 Channel
- Voltage to operate: 5V D
- Color : Blue Relays on a black PCB
- Load : 10A, AC 250V/ 15A, 125V

9. LCD Module:-

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. This isused to display the Dimension data i.e Diameter and the height of object.
16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots

Figure 6.1.9: LCD Module

Specifications:-

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

10.I2C Module:-

The I2C is a type of serial bus developed by Philips, which uses two bidirectional lines, called SDA (Serial Data Line) and SCL (Serial Clock Line). Both must be connected via pulled-up resistors. The usage voltages are standard as 5V and 3.3V.

I2C Module has a inbuilt PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display. These modules are currently supplied with a default I2C address of either 0x27 or 0x3F. To determine which version you have check the black I2C adaptor board on the underside of the module. If there a 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly

You should usually have only four pins to hook up. VCC and GND of course. The LCD display works with 5 Volts. So we go for the 5V Pin.

The values shown on the display can be either a simple text or numerical values read by the sensors, such as temperature or pressure, or even the number of cycles that the Arduino is performing.

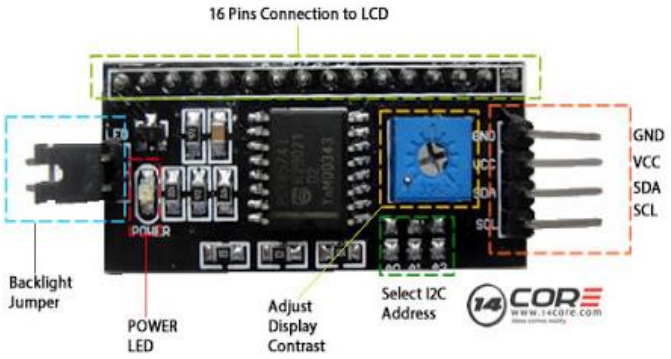


Figure 6.1.10: I2C Module

Specifications: -

- Operating Voltage: 5V
- Backlight and Contrast is adjusted by potentiometer
- Serial I2C control of LCD display using PCF8574
- Come with 2 IIC interface, which can be connected by Dupont Line or IIC dedicated cable
- Compatible for 16x2 LCD
- This is another great IIC/I2C/TWI/SPI Serial Interface
- With this I2C interface module, you will be able to realize data display via only 2 wires.

11.Linear solenoid i.e. Linear Actuator:-

The linear solenoid works on the same basic principal as the electromechanical relay. A "Linear Solenoid" is an electromagnetic device that converts electrical energy into a mechanical pushing or pulling force or motion.

Linear solenoids basically consist of an electrical coil wound around a cylindrical tube with a Ferro-magnetic actuator or "plunger" that is free to move or slide "IN" and "OUT" of the coils body. Solenoids can be used to electrically open doors and latches, open or close valves, move and operate robotic limbs and mechanisms, and even actuate electrical switches just by energizing its coil.

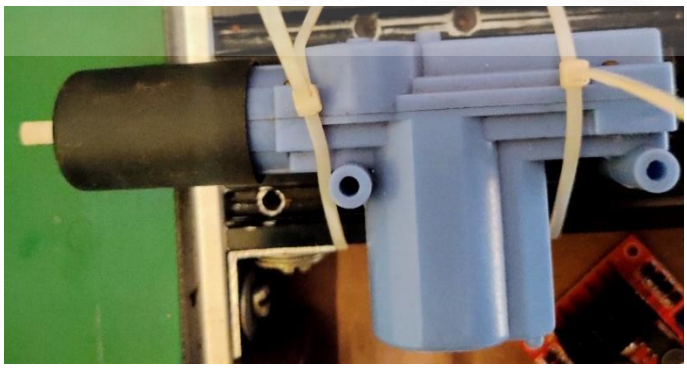
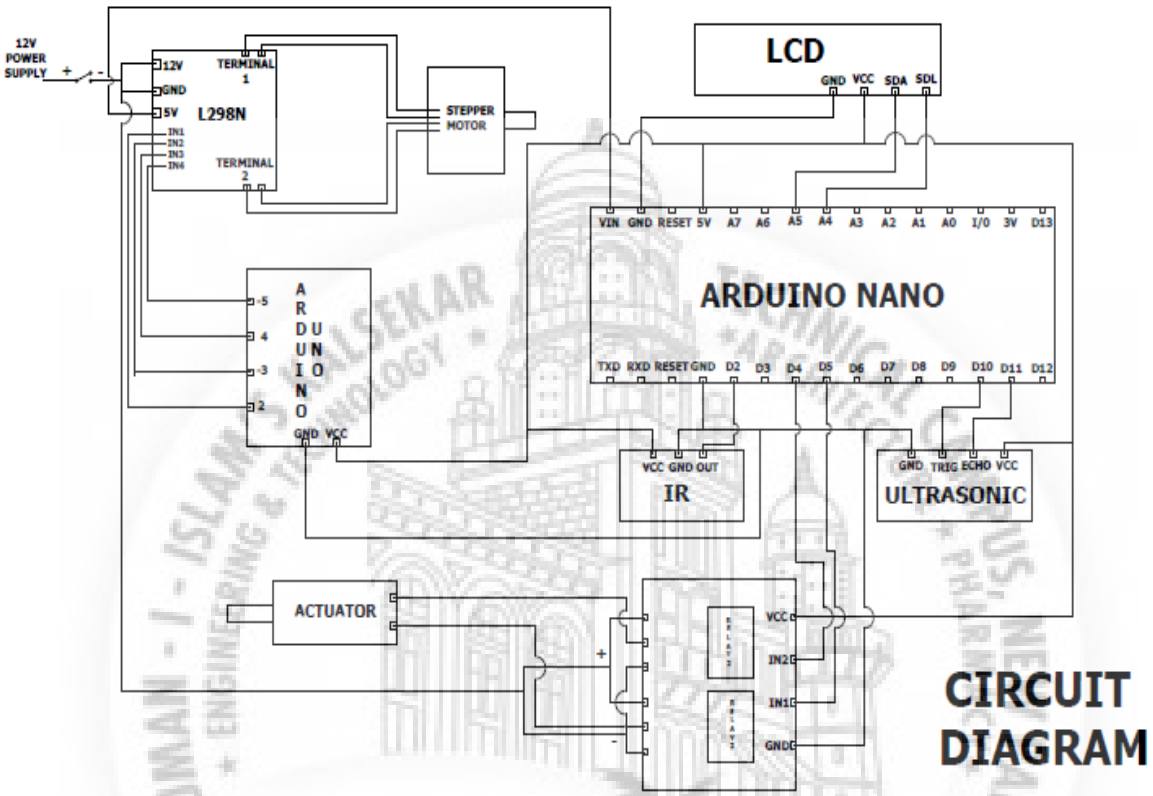


Figure 6.1.11: Linear Solenoid Module



6.2 ELECTRICAL CIRCUIT

DESCRIPTION OF CIRCUIT DIAGRAM

1) 12V ADAPTER POWER SUPPLY: -

The 12V power supply is connected to motor driver L298N to run 12V stepper motor and connected to 12V actuator.

2) L298N MOTOR DRIVER: -

The L298N motor driver is powered from 12V adapter and connected in pin 6-35V and GND. The stepper motor is connected to output terminals and 5V pin is powered to Arduino nano and inputs pin are connected to Arduino uno.

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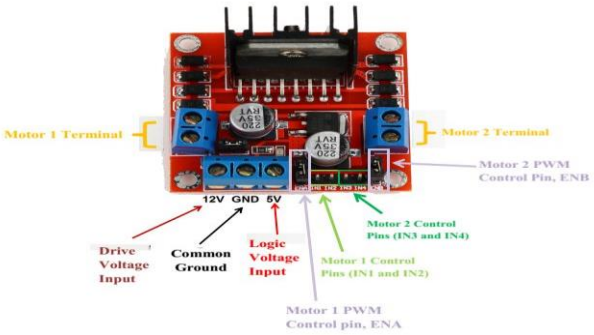


Figure 6.2.2: L298N Stepper Driver

3) ARDUINO NANO:-

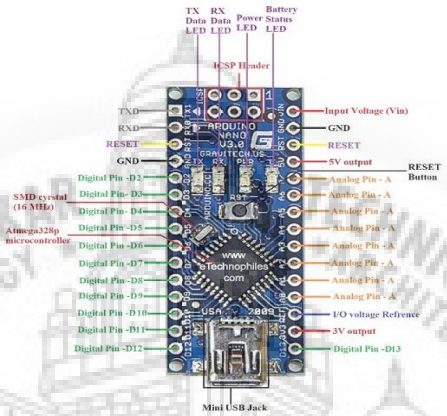


Figure 6.2.3: Arduino Nano

In Arduino nano power supply is from pin vin and it connected to L298N motor driver pin 5V.

The Arduino nano is controlling ultrasonic sensor, ir sensor, actuator and lcd showing outputs.

The ultrasonic sensor vcc and ground is connected to Arduino nano and trig is connected to D10 pin and echo is connected to D11 pin in Arduino nano.

The ir sensor vcc and ground is connected to Arduino nano and output pin is connected to D2 pin in Arduino nano.

To operate actuator 2 relay are connected to vcc and ground in Arduino nano and IN2 is connected to D4 pin and IN1 is connected to D5 pin in Arduino nano.

The LCD vcc and ground is connected to Arduino nano and SDA is connected to A4 pin and SDL is connected to A5 pin in Arduino nano.

4) RELAY:-

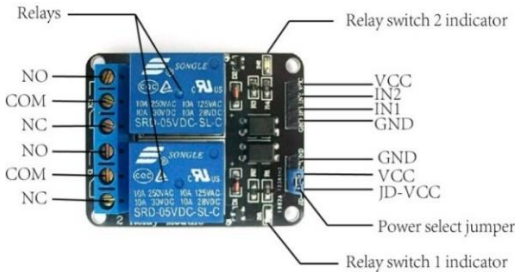


Figure 6.2.4: Relay

In relay input IN2 pin is connected to D4pin and IN1 pin is connected to D pin in Arduino nano and vcc and ground is connected to Arduino nano. Relay are also connected to actuator. In relay NO pin is short to the positive terminal of 12V and NC pin is short to the negative terminal of 12V and one positive wire of actuator is connected to COM pin in relay and other negative wire of actuator is connected to other COM pin in relay.

5) ARDUINO UNO:-

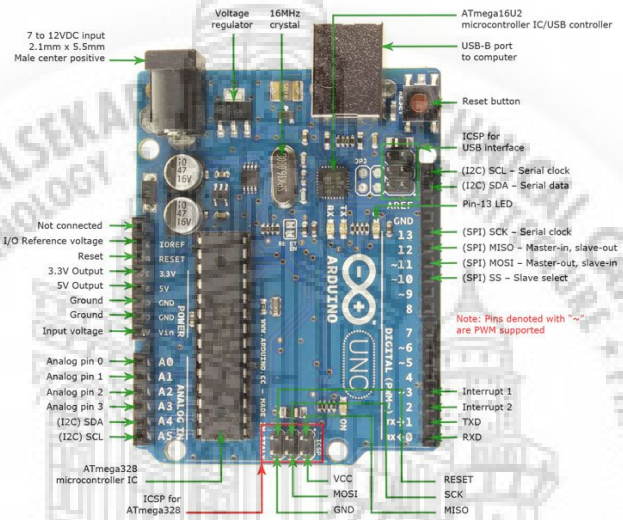


Figure 6.2.5: Arduino Uno

In Arduino uno vcc and ground is connected from Arduino uno. Input pin i.e 2,-3,4,-5 is connected to motor drive L298N.

CHAPTER 7

ARDIUNO PROGRAMMING

CHAPTER 7

ARDIUNO PROGRAMMING

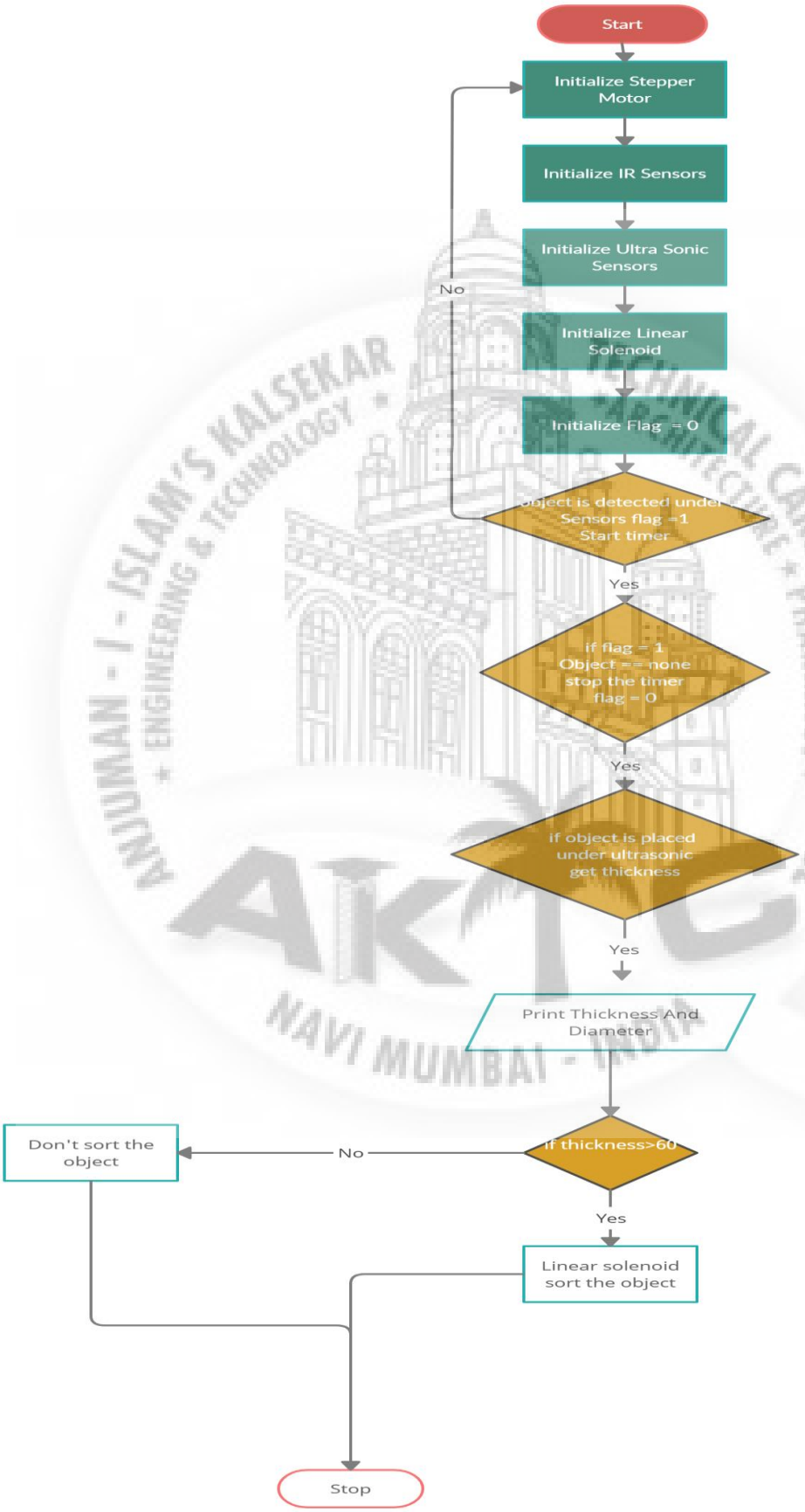
7.1 INTRODUCTION :

This chapter involves the Ardiuno programming of the Automatic Sorting Machine by using Ardiuno IDE. Since for the controlling part of the system we are using Ardiuno Uno and Nano , the software we are using is Ardiuno IDE . IDE stands for Integrated Development Environment - An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go.

7.2 ARDIUNO IDE :

1. Ardiuno Ide is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
2. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
3. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.
4. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
5. Each of them contains a microcontroller on the board that is actually programmed and information in the form of code.
6. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
7. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.
8. This environment supports both C and C++ languages.

7.3 ALGORITHM :



ARDIUNO CODING :

7.4.1 ARDIUNO NANO CODING :

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);  // Set the LCD address to 0x27 in PCF8574 by NXP and
Set to 0x3F in PCF8574A by Ti

long duration, distance;

int pusher_A = 5;
int pusher_B = 4;

long interval=0;

#define trigPin  10
#define echoPin  11

#define IR_Pin    2
int IR_status;

long start_millis;
long stop_millis;

int object_thickness=60;

int start_flag=0;

void push()
  {
    digitalWrite(pusher_A, LOW);
    digitalWrite(pusher_B, HIGH);
    delay(800);
    digitalWrite(pusher_A, HIGH);
    digitalWrite(pusher_B, HIGH);
  }

void pull()
  {
    digitalWrite(pusher_A, HIGH);
    digitalWrite(pusher_B, LOW);
    delay(800);
    digitalWrite(pusher_A, HIGH);
    digitalWrite(pusher_B, HIGH);
  }

void get_thickness()
  {
     delay(5);                              // waits for 5 milli-seconds
```

```
    digitalWrite(trigPin, LOW);                // make Trigger Pin of Ultrasonic sensor LOW
    delayMicroseconds(2);                      // waits for 2 micro-seconds
    digitalWrite(trigPin, HIGH);               // make Trigger Pin of Ultrasonic sensor HIGH
    delayMicroseconds(10);                     // waits for 10 micro-seconds
    digitalWrite(trigPin, LOW);                // make Trigger Pin of Ultrasonic sensor LOW
    duration = pulseIn(echoPin, HIGH);         // make Echo Pin of Ultrasonic sensor HIGH
    distance = ((duration / 2) / 29.1);        // calculate the distance as function of time
  }
void get_diameter()
{
  if(start_flag==0)
    {
     IR_status=digitalRead(IR_Pin);
     if(IR_status==LOW)
       {
        interval=0;
        start_flag=1;
        start_millis=millis();
       }
    }

  if(start_flag==1)
    {
     IR_status=digitalRead(IR_Pin);
     if(IR_status==HIGH)
       {
        start_flag=0;
        stop_millis=millis()
        interval = stop_millis-start_millis;
       }
    }
}
void setup()
{
  lcd.begin();
  lcd.clear();

  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(IR_Pin, INPUT);
  pinMode(pusher_A,OUTPUT);
  pinMode(pusher_B,OUTPUT);

  digitalWrite(pusher_A, HIGH);
  digitalWrite(pusher_B, HIGH);

  lcd.setCursor(0,0);
  lcd.print("Thickns  Diamtr");
}
```

```
void loop()
{
  get_thickness();
  lcd.setCursor(2,1);
  lcd.print("        ");
  lcd.setCursor(2,1);
  lcd.print((18-distance)*10);

  get_diameter();
  lcd.setCursor(10,1);
  lcd.print("        ");
  lcd.setCursor(10,1);
  lcd.print((interval/10)/5);

  if(((18-distance)*10) > object_thickness)
    {
      delay(1000);

      push();
      delay(2700);
      pull();
    }

  delay(100);
}
```

7.4.2 ARDIUNO UNO CODING :

```
#include <Stepper.h>
const int stepsPerRevolution = 200;  // 1.8*200=360 Degrees
Stepper myStepper(stepsPerRevolution, 2,3,4,5);

void setup()
{
  myStepper.setSpeed(60);
}

void loop()
{
  myStepper.step(1);
  delay(10);
}
```

CHAPTER 8

RESULT AND CONCLUSION

CHAPTER 8

RESULT AND CONCLUSION

8.1 READING & OBSERVATION

Measurement using scale

Job 1: -

Diameter=46, Height=60

Job 2: -

Diameter=40, Height=110

Measurement by Automatic Job Sorting Machine

JOB NO	Thickness (mm)	Diameter (mm)	Error Thickness %	Error Diameter %
1	60	47	0	-2.17
	60	45	0	+2.17
	60	46	0	0
2	110	39	0	+2.17
	110	41	0	-2.17
	110	40	0	0

8.3 RESULTS: -

From the above reading and observation, we can Validate that the machine can measure thickness and the diameter with the precision of ±1mm respectively.

8.4 CONCLUSIONS: -

Our main aim of project is to detect the dimension by using sensors. In industry inspection department faculty is there to check the dimension. By using our project, we can eliminate the faculty to check dimension of job and sort according to dimension without any human intervention with the precision of **±1**mm respectively.

CHAPTER 9
COST ESTIMATION OF THE PROJECT

CHAPTER 9

COST ESTIMATION OF THE PROJECT

SR NO	PARTICULAR	COST (RS)/UNIT	COST (RS)
1	**STRUCTURE COST**		
1.1	ALUMINIUM EXTRUSION ROD	500*6	3000
1.2	L SHAPE CORNER CONNECTOR	50*30	1500
1.3	NUTS AND SCREW	25*40	1000
1.4	PLATE	50*4	200
1.5	BEARING	30*4	120
1.6	ROLLER	200*2	400
1.7	BELT	500*1	500
1.8	SENSOR MOUNTING	50*2	100
2	**ELECTRONIC PARTS**		
2.1	STEPPER MOTOR	500*1	500
2.2	ULTRASONIC SENSOR	80*1	80
2.3	IR SENSOR	45*1	45
2.4	L293D MOTOR DRIVER MODULE	100*1	100
2.5	LINEAR SOLENOID	550*1	550
2.6	ARDUINO UNO	450*1	450
2.7	NANO ARDUINO	200*1	200
2.8	JUMPER WIRE	2*40	80
2.9	LCD SCREEN	100*1	100
2.10	RELAY	205*1	205
2.11	POWER SUPPLY	350*1	350
TOTAL			**9480**

CHAPTER 10

FUTURE SCOPE

CHAPTER 10

FUTURE SCOPE

1. After doing some modification in the system various types of inspection Parameter such as Diameter, hole diameter, Height Thickness, Surface defect Crack, burr Roundness Minor and major diameter, Chamfer angle etc.

2. Further image processing can be implemented measuring difficult contours.

3. In our project we are feeding the product manually but it can be also done automatically by using robotic arm or hopper.

4. In future further sorting parameters can be included to sort the product such as weight, colour, types of materials, etc.

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