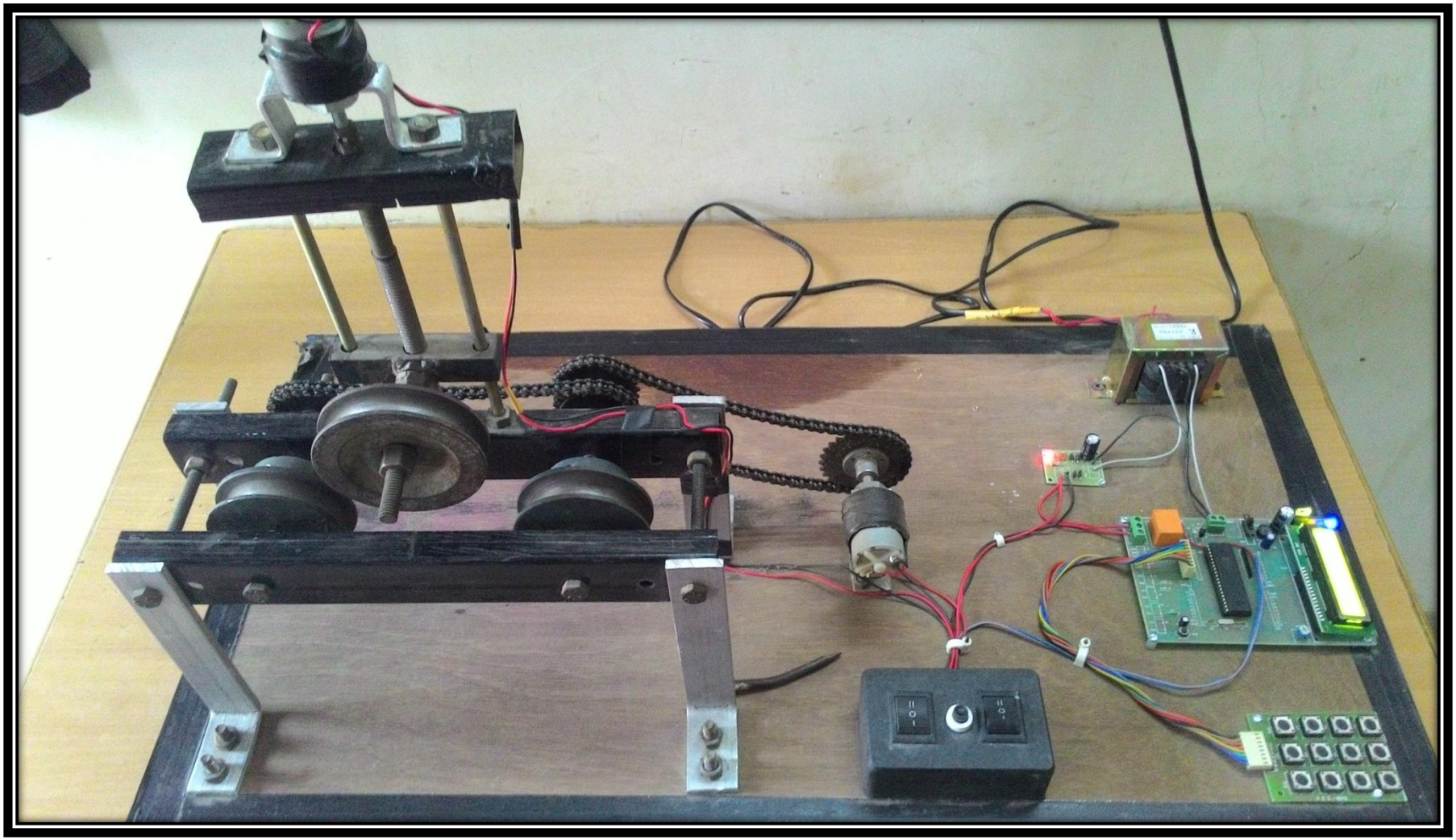
PRESENTATION ON
DESIGN AND DEVELOPMENT OF PIPE BENDING MACHINE



SMT. S. R. PATEL ENGINEERING COLLEGE, DABHI

A PRESENTATION ON
DESIGN AND DEVELOPMENT OF PIPE BENDING MACHINE

Group No- 10

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- Introduction
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- Classification Of Pipe Bending Machine
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Outline

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What Is Bending??

- Bending implies the deformation of a workpiece produced by loads perpendicular to its axis as well as force couple acting in a plane passing through the axis of the bar.

- Bending is only occurred when load is acting perpendicular to the neutral axes of pipe

Introduction

➢In modern days, all area of industries are going to like automated, economically and accurate machinery .There is many types of pipe bending machine are available in market like hydraulic pipe bending machine, pneumatic pipe bending machine, manual pipe bending machine etc.

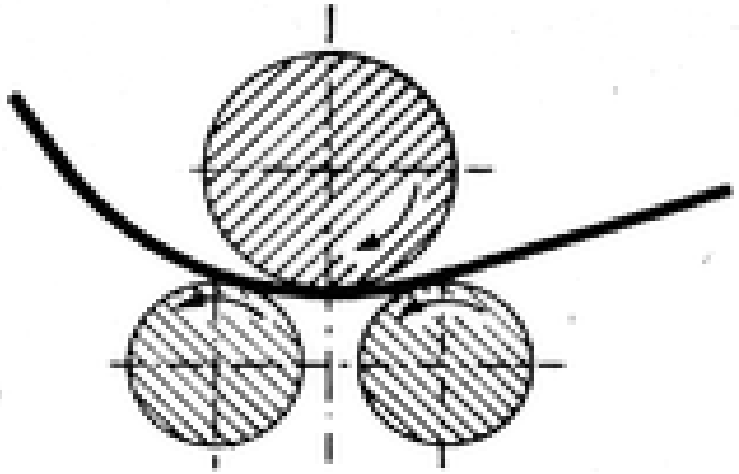
The utility model discloses a full-automatic pipe bending machine. Whole machine is supported by a base with four supporting legs which has enough strength to carry the weight and force of machine. Two parallel shaft are clamped on base by clamps which carry the lower pulley. Pulley are driven by dc motor with chain drive mechanism. Here two guide ways are use for guide the working pulley for up & down linear motion. Pulley gets that motion from Lead screw is working as a nut and bolt mechanism. The lead screw is get rotary motion from upper dc motor. Guide way and lead screw are fitted between two horizontal supporting plate, which are fitted on frame by the help of the two vertical parallel supporting plate. Microcontroller Unit consist of transformer, rectifier, capacitor, display Production efficiency is improved, the production cost is reduced, and the application range is wide.

Classification Of Pipe Bending

- Press Bending
- Rotary Draw Bending
- Mandrel bending
- 3 Roll Bending
- Bending springs
- Heat induction bending
- Sand packing/hot-slab bending

3 ROLL BENDING

- 3-roll bending is also used for producing work pieces with large bending radii. The method is similar to the ram bending method, but the working cylinder and the two stationary counter-rollers rotate, thus forming the bend. Normally there are 2 fixed rollers and one moving roller and the work piece is passed forward and backward through the rollers while gradually moving the working roller closer to the counter rollers which changes the bend radius in the pipe.

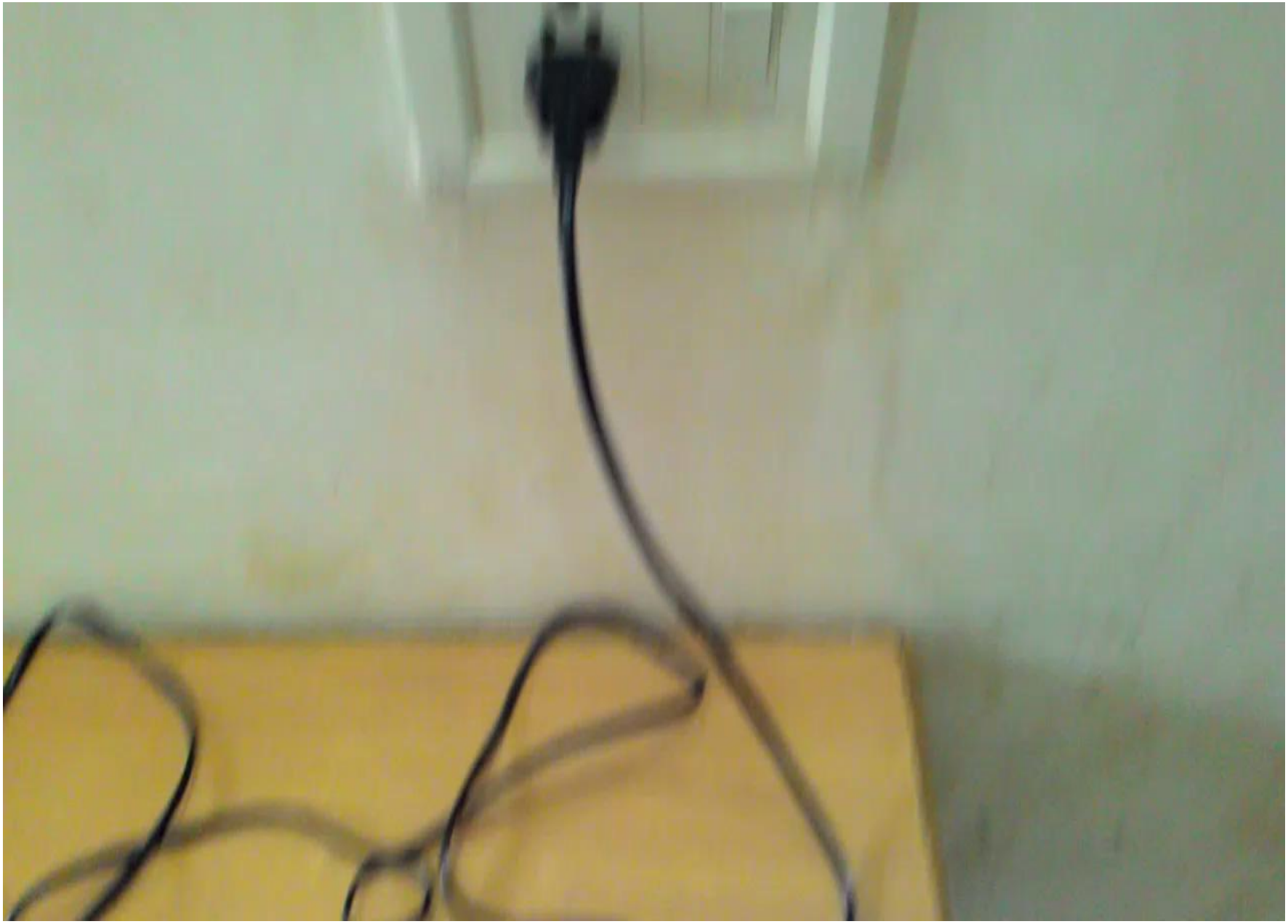


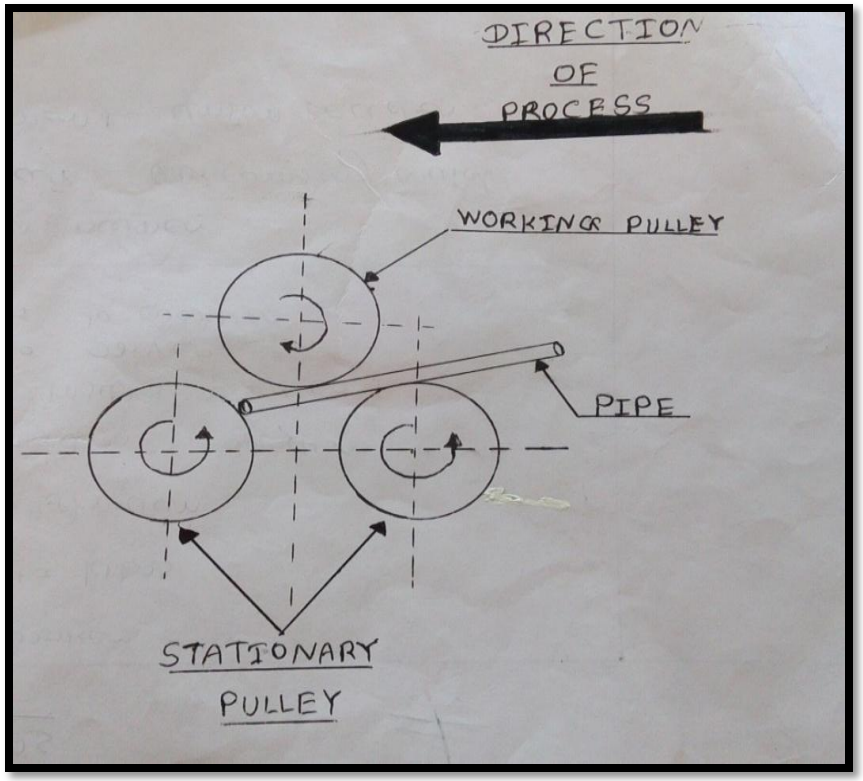
3 Roll Bending

Working Principle Of Microcontroller based 3 Roll Pipe Bending Machine

- 3-roll bending is used for producing work pieces with large bending radii. The method is similar to the ram bending method, but the working pulley and the two stationary counter-pulley rotate, thus forming the bend. Normally there are 2 fixed pulley and one moving pulley and the work piece is passed forward and backward through the pulley while gradually moving the working pulley closer to the counter pulley which changes the bend radius in the pipe. This method of bending causes very little deformation in the cross section of the pipe and is suited to producing coils of pipe as well as long sweeping bends like those used in powder transfer systems where large radii bends are required.

Pipe enter through one side of machine with guidance of stationary pulley. Pipe is held at the initial point of second pulley as shown in figure, after enter the sufficient distance in display. Then microcontroller 89s52 gets signals from keypad by entering amount required for travelling the upper pulley. Upper dc motor gets signals from Microcontroller IC. By this Upper pulley can move up and down so, for producing uneven shaped pipe this automatic motion is used. By entering various amount of distance as the shaped required the upper pulley moves up and down for generating uneven shaped pipe. Also the continuous radius of curvature can achieved of pipe..





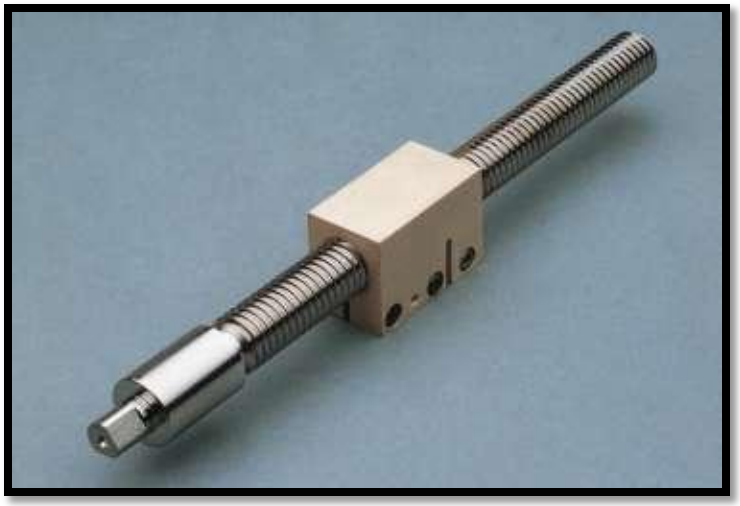
Initial Condition

Running Condition

Component Of Machine

- **Lead Screw**

  Here lead screw used for convert the rotary motion into linear motion.



- **Bearing**

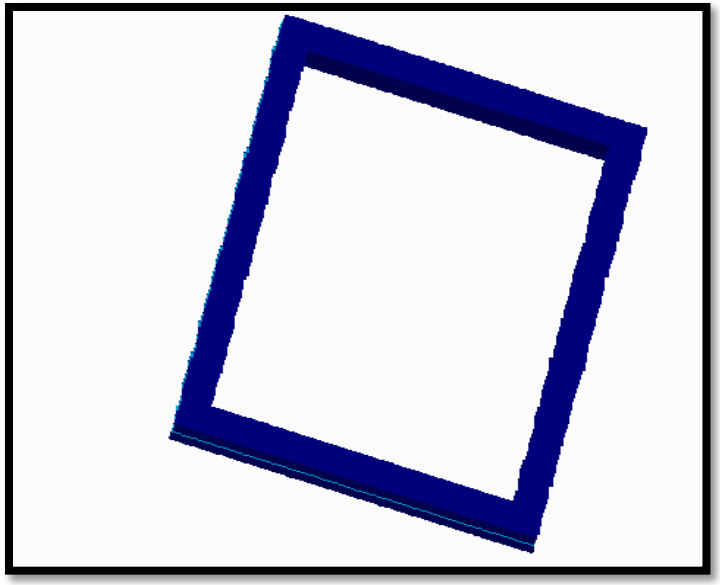
  Bearings used is radial bearing as a supporting part for shaft which allow the rotary motion and reduce the friction of shaft.

- **Shaft**

Shaft is used for transmit power from motor to pulley.

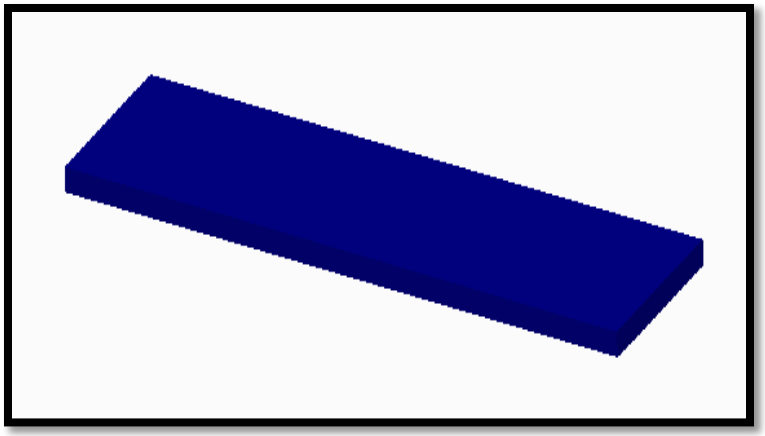
- **Base**

Base is the supporting member for all parts of machine.



- **Supporting Plates:-**

  Supporting plates are used for giving support to the lead screw and guide ways.



- **Pulley:-**

  Pulley is generally used as a DIE which allows to bent the pipe.

- **Clamps:-**
  Clamps are used for holding the shaft of stationary pulley on base table.

•**Chain Drive**
A chain drive is a mechanism for transferring mechanical power between two places, and is a common means of locomotion in bicycles and motorcycles. It is also a motive source for many different types of machinery

- **Dc motor:-**

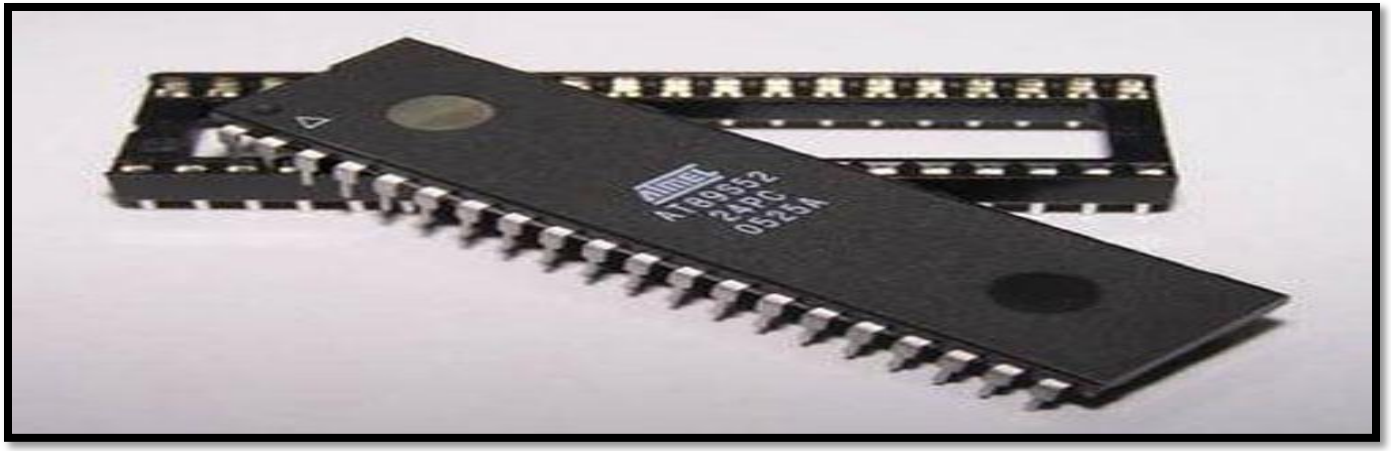
  A simple dc motor is used for drive the shaft of stationary pulley.

- **Guide Ways:-**

  Guide ways are used for guide the working pulley to the top edge of pipe from upper supporting plate.

• **Microcontroller IC:-**

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. **T**he AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry.



•**Transformer:-**

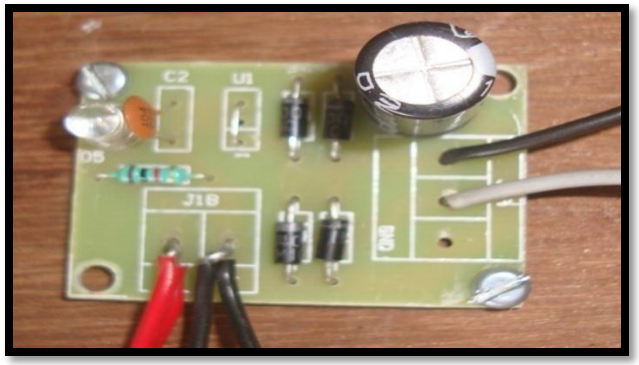
Transformer used for convert 230v to 12v.

This transformer works on 3 Ampere.

•**Rectifier circuit:-**

Capacitor converts the AC to DC.

Because Both motors are works on DC.



•**7805 IC:-**

This IC converts 12v to 5v.

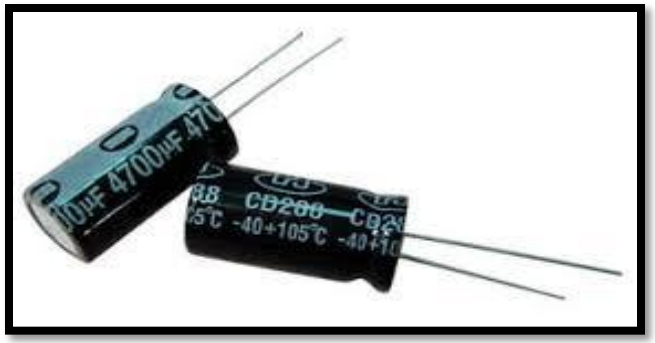
Because Microcontroller and the display works on 5volts.

•**Relay switch:-**

This switches controls the upper motor.

•**Capacitor:-**

Its converts DC voltage in pure DC voltages.



Project Objective

This project is developed to study about the automation in process of pipe bending industries. Mainly preferable for small industries. The main purpose of this project are listed below:

- To increase the accuracy of product.
- To reduce the man effort.
- To reduce the time consumption.
- To reduce the material waste compare of the manual pipe bending
- Less Machine setup time is required
- To produce uneven shaped bend pipes or products.

Literature Review

- In april,2013 Prof. Nilesh Nirwan and Prof. A.K.Mahalle,Department of Mechanical Engineering, G.H. Raisoni college of engineering Nagpur has found a PORTABLE ROLLING PIPE BENDING MACHINE is used for reliability, easy convey and good quality purpose. But there is some difficulties like not used for mass production and slow process due to hand operated device.

- In Nov, 2015 Prof. A. Pandiyan Of Department of Mechanical Engineering, Of Saveetha School of engineering Chennai has found a ZIGZAG PIPE BENDING MACHINE is used for making zigzag profile pipe. It is operated by hydraulic bottle jack. This bending machine is only used for zigzag profile so, not used for other bending operations.

- In Sep, 2011 Prof. N.N. Jadeja Of Department of Mechanical Engineering, Of GEC Bhvnagar has found MANUALLY OPERATED PIPE BENDING MACHINE is used in small industries. This machine generally used for low cost purchasing purpose. It has low accuracy of bending and force is not uniformly distributed over a whole length of pipe so, this bending machine is not preferable.

- H.A. Husain, M. Sohil Pervez Of Department of Mechanical Engineering, Of Anjuman college of engineering and Technology, Chennai Nagpur, has found a BICYCLE INTEGRATED PIPE DESIGN BENDING MACHINE. It is unlike other electric motor operating pipe bending machine. It is used for ECONOMIC & ACCURATE DIMENSION. It will help to maintain environment green. Here is one Disadvantage is process taking more time.

- In May, 2014 Basil Okafor & Danial Obiora Of Department of Mechanical Engineering, of Fedral University Owerri Nigeria has found MOTORIZED PIPE BENDING MACHINE WHICH IS OPERATED by 2HP MOTOR. This machine can run in both upward and downward direction. Here worm and wheel gear mechanism is used. Mandrel used for less thickness pipes.

Industry Survey

We had seen pipe bending machine in few company like

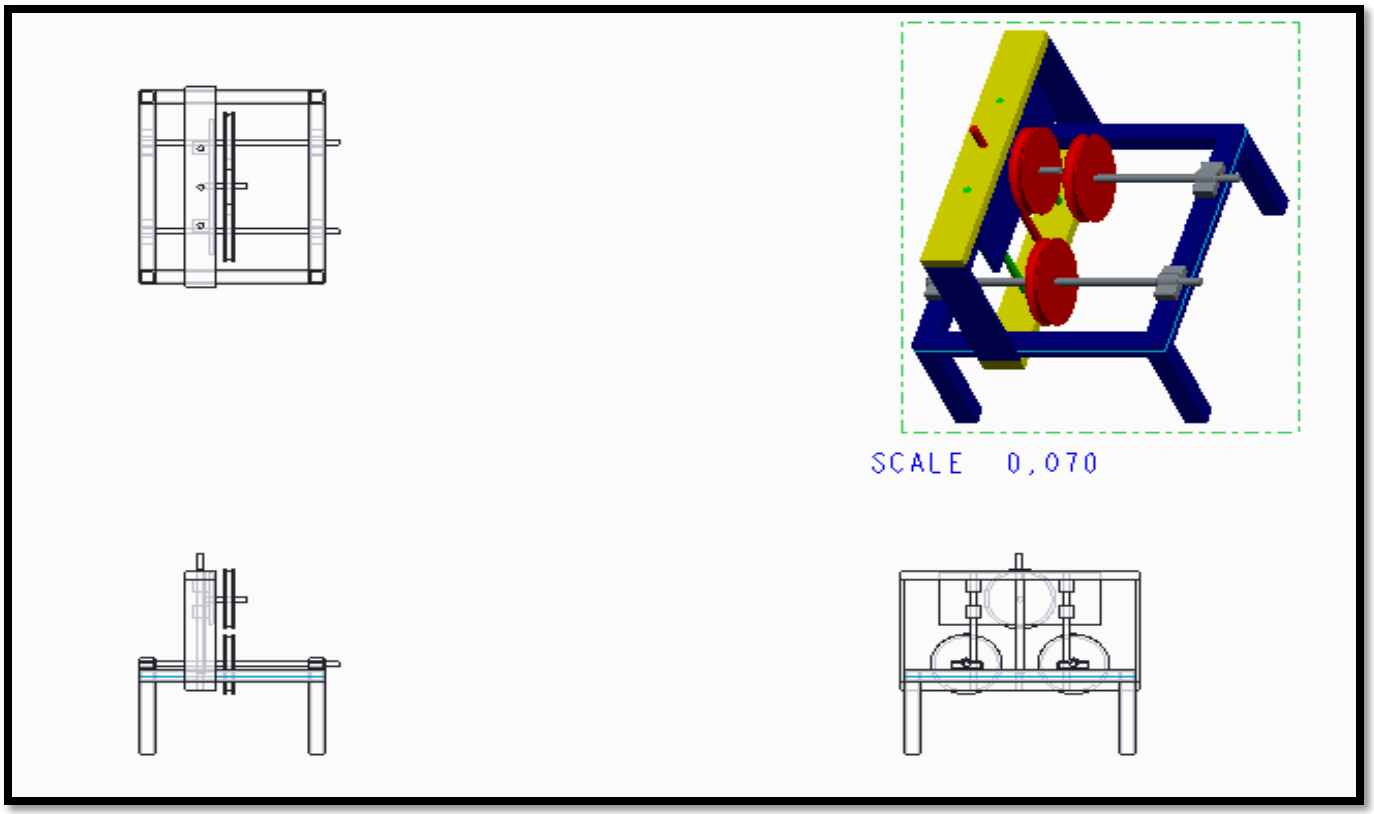
1).Heavy Metals & Tube ltd. 2) shayona engineering

3) Om engineering 4) Mahaser engineering, We seen that they company are facing problems like lake of automation and they can not get fast process of bending.

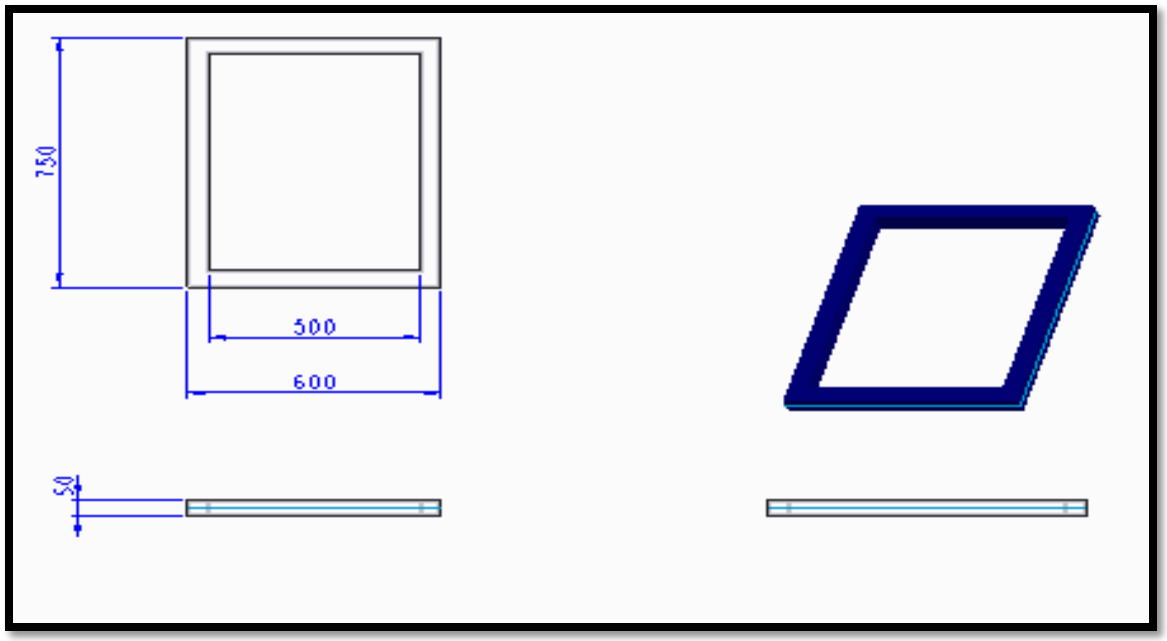
RESEARCH GAP

- The improvement in some fields in this process like reduction of cost.
- High flexibility because of different types of parts can be bend by changing die.
- Uneven shaped of pipe can be generated.

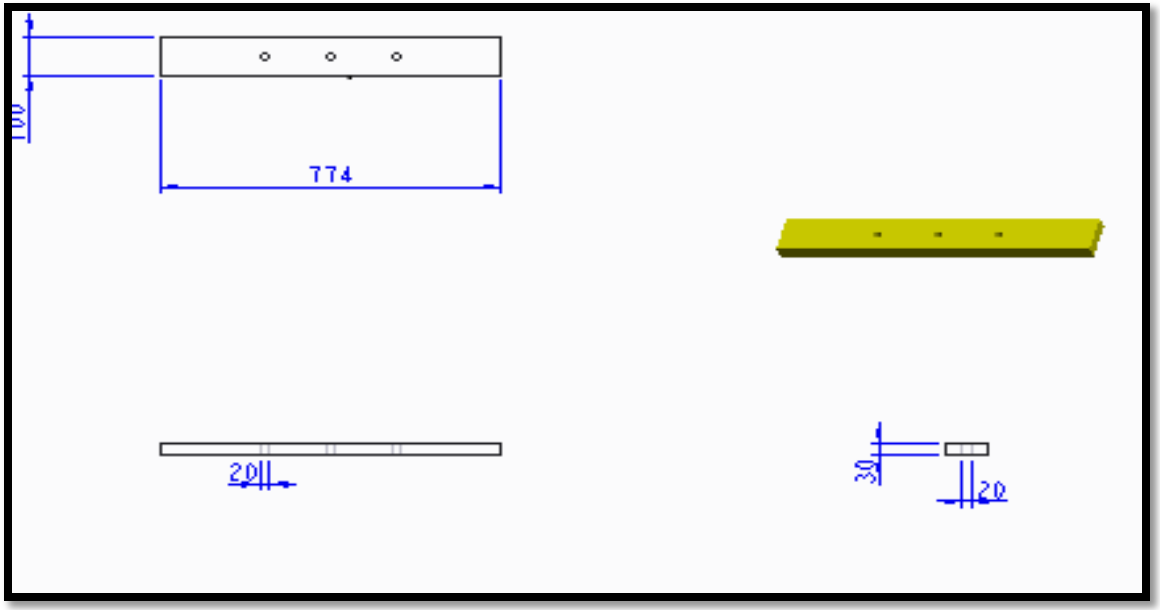
Design of Machine



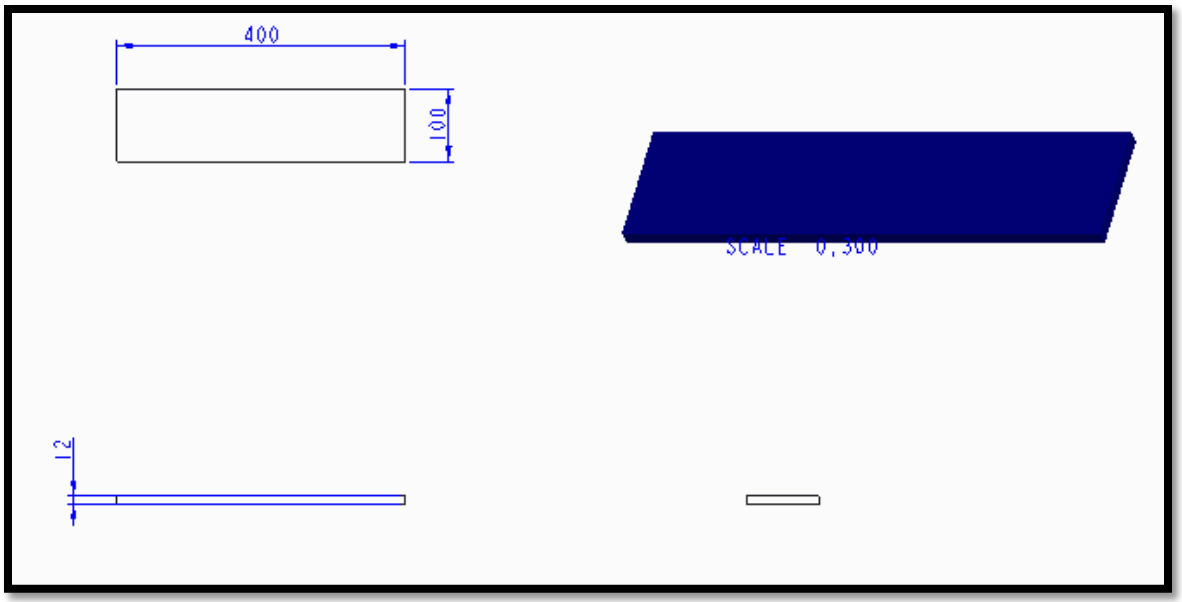
Model Assembly



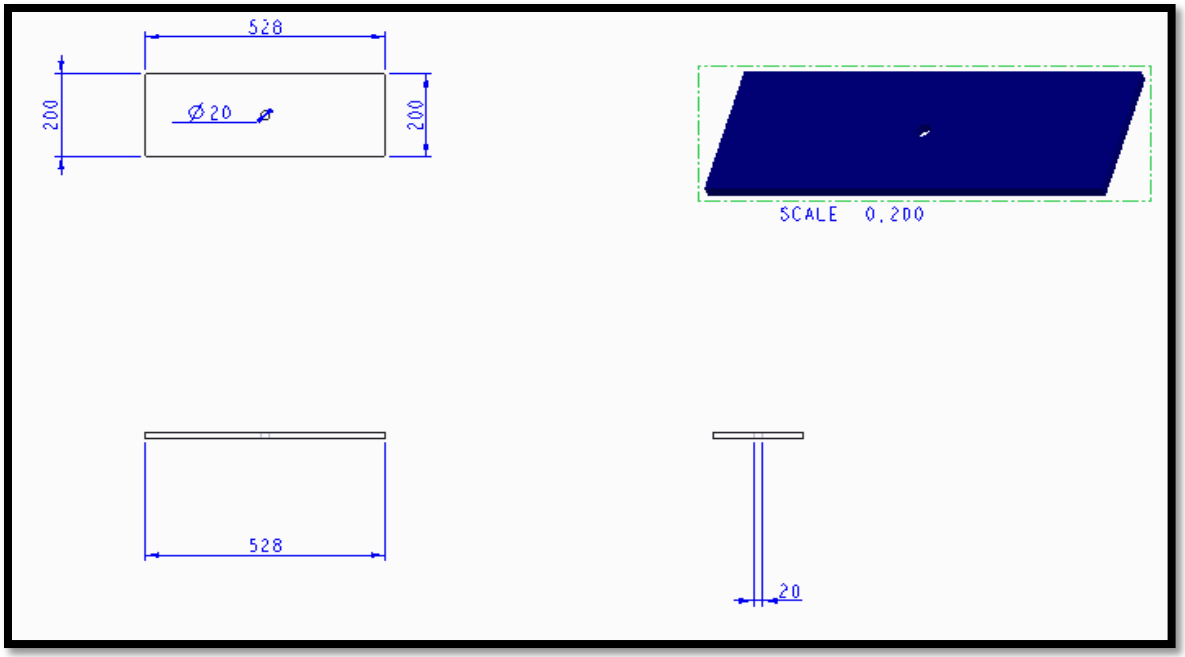
Base (frame)



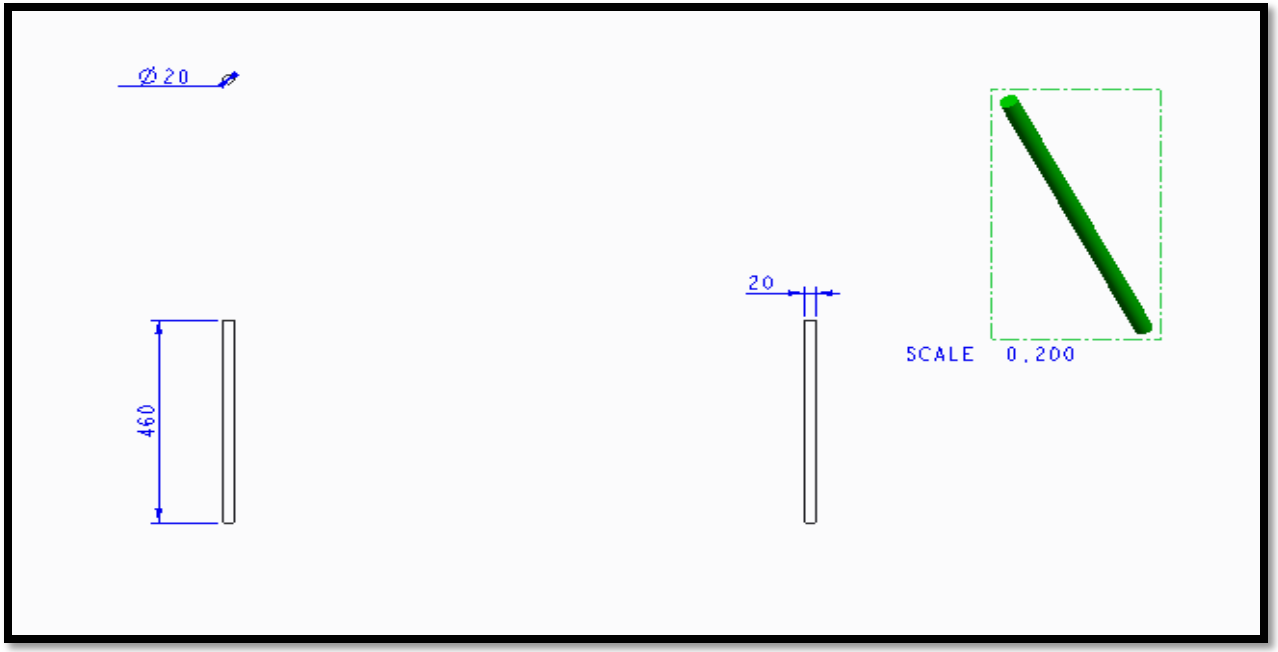
Upper Supporting Plate



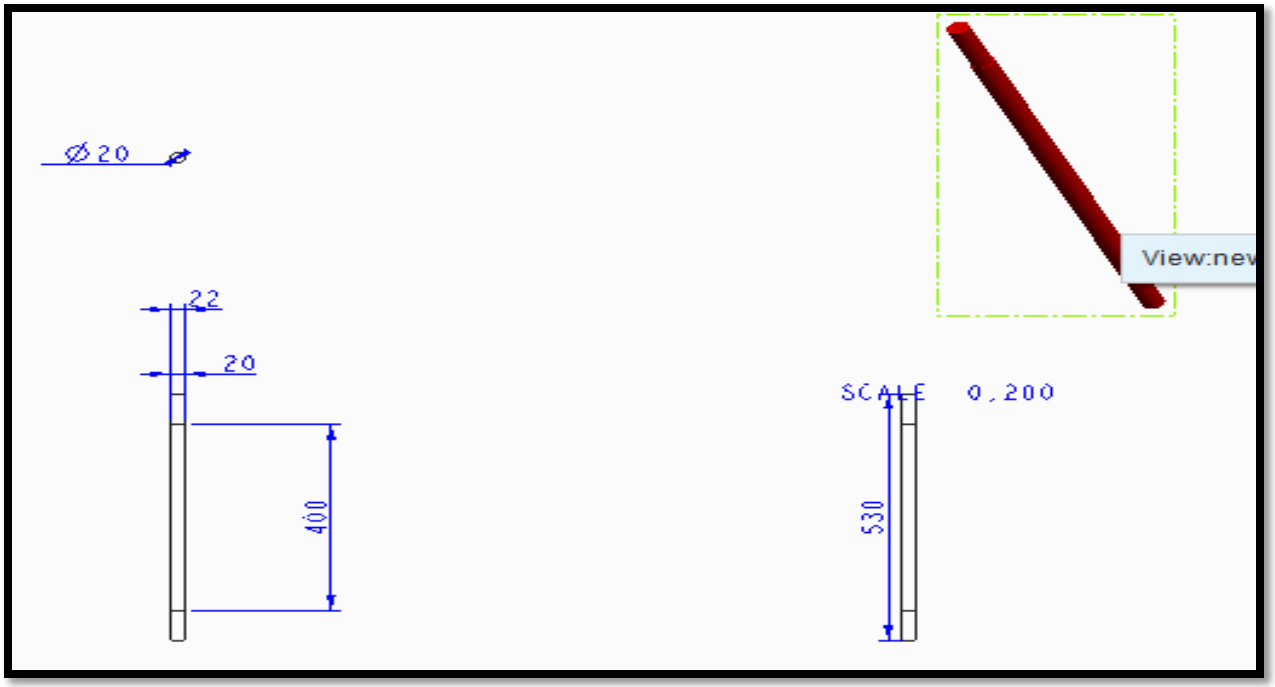
Vertical Supporting Plate



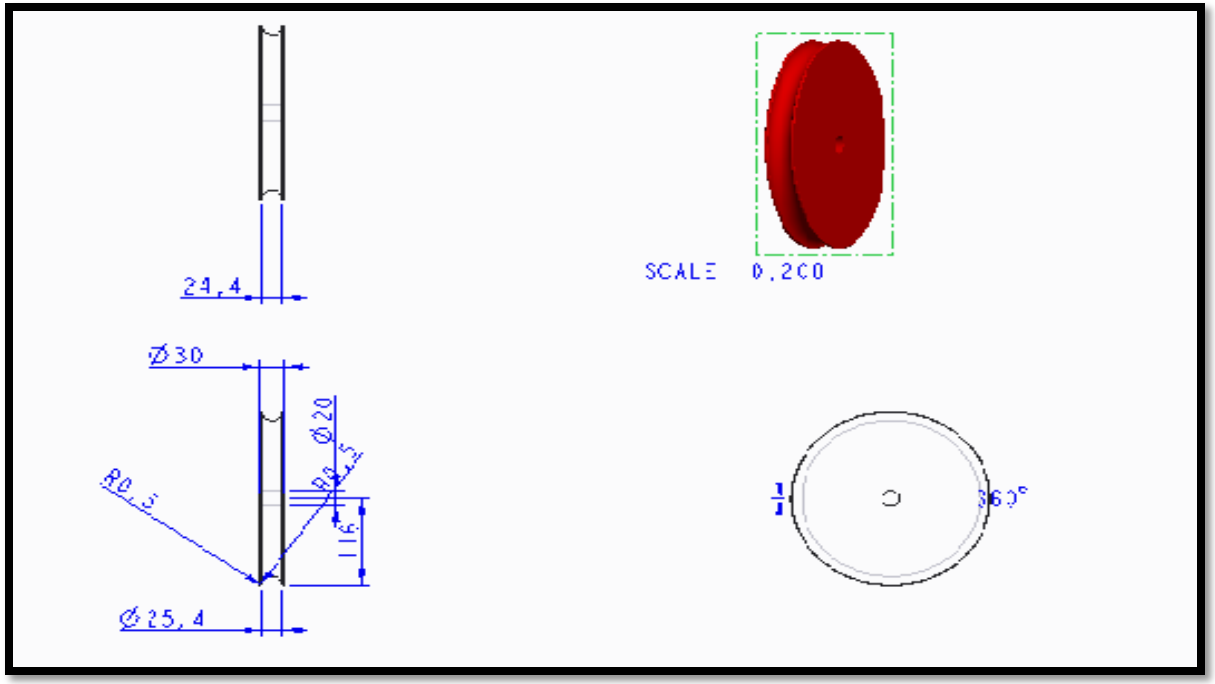
Working Pulley Holding Plate



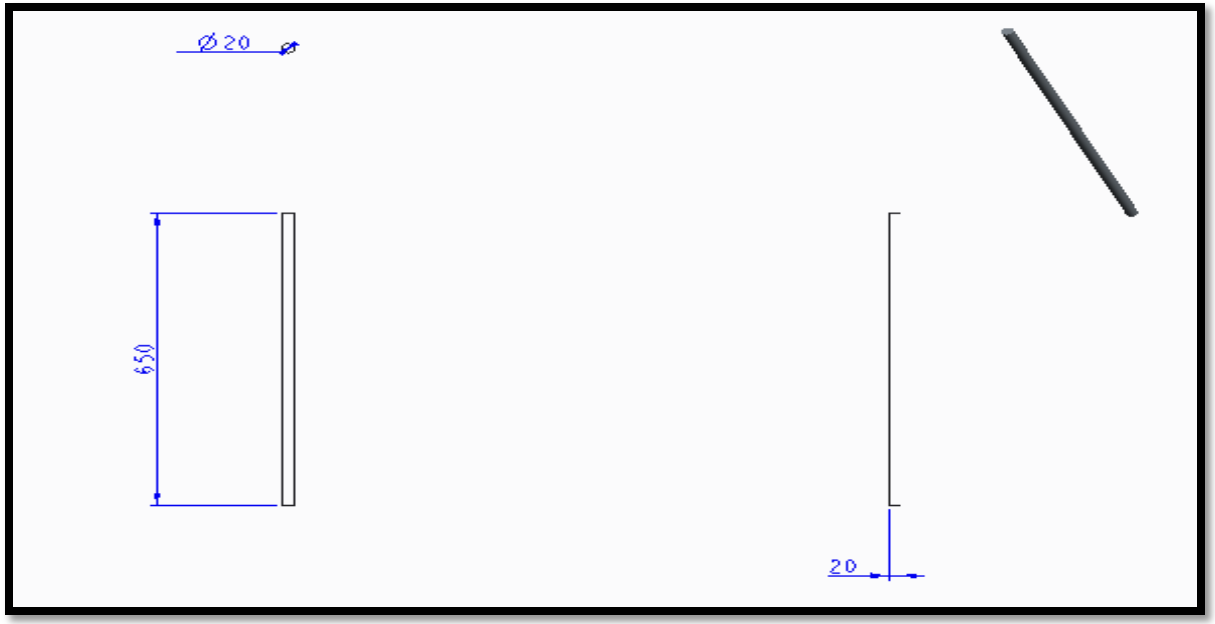
Guide Way



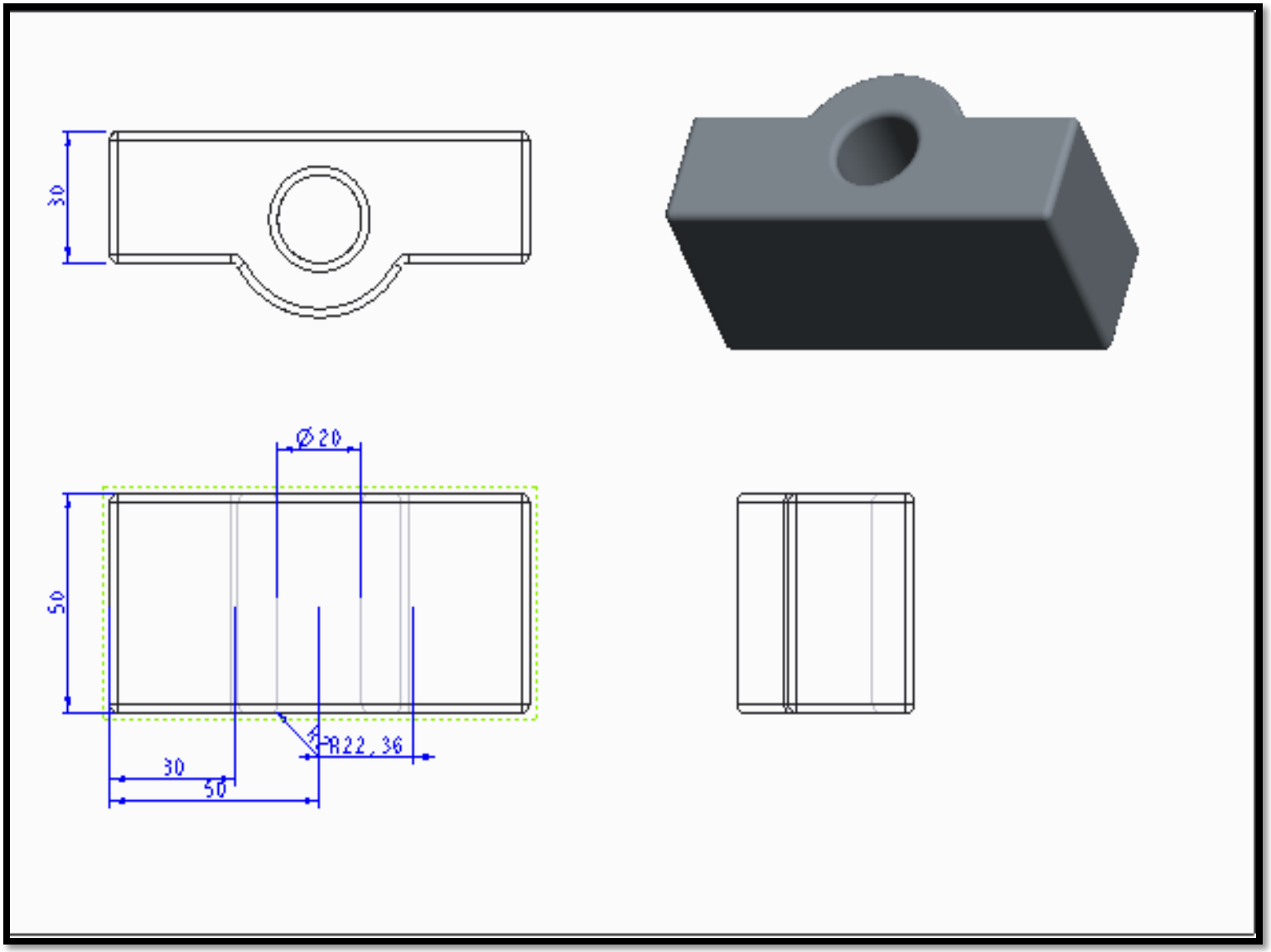
Lead Screw



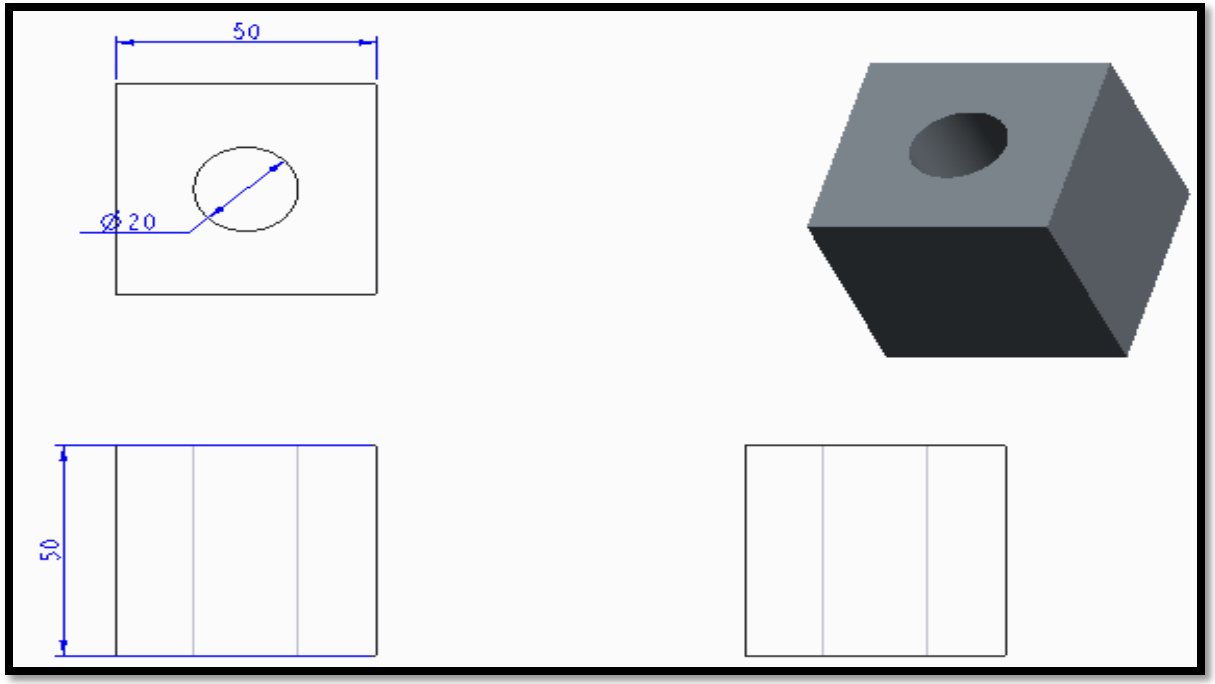
Pulley



Shaft



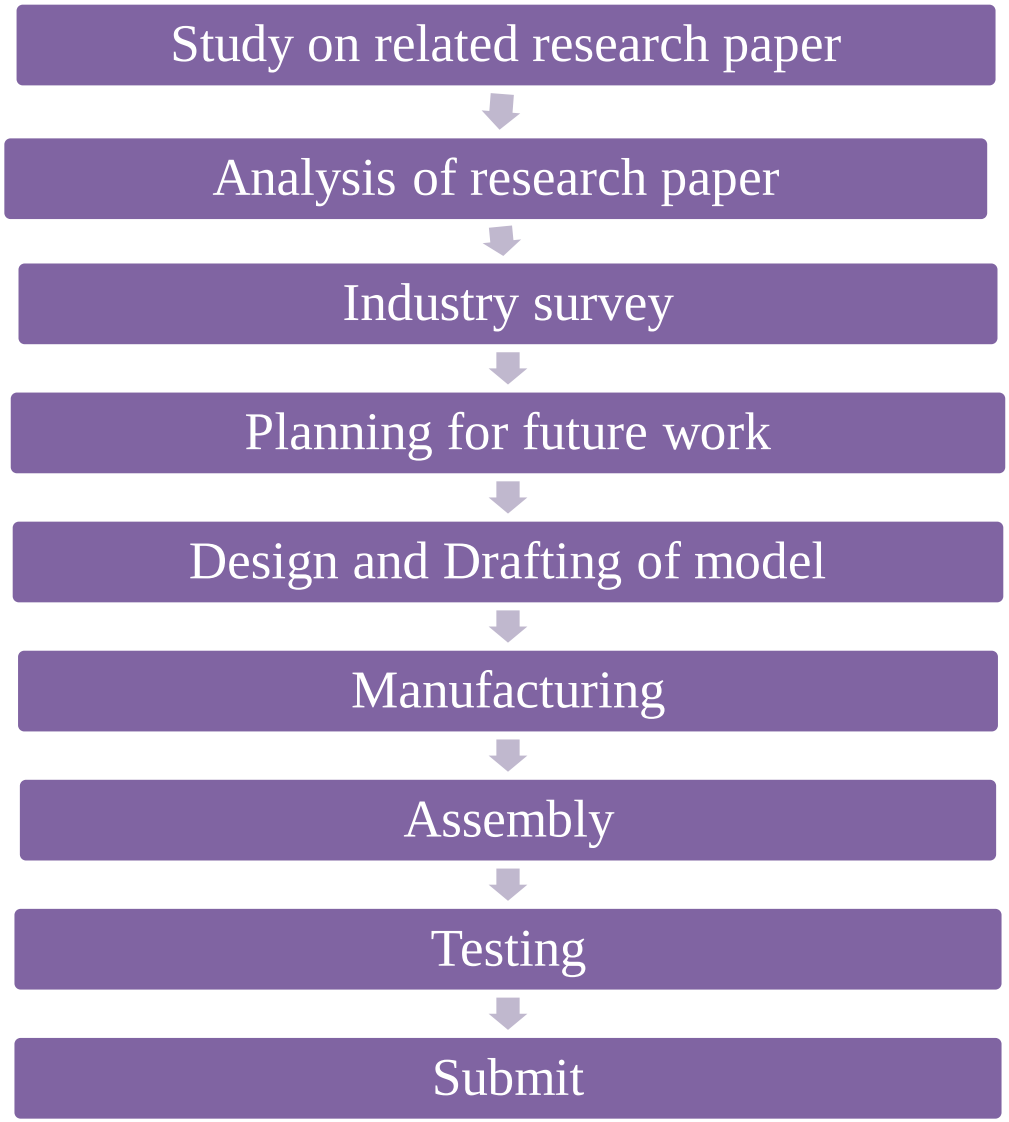
Clamp



Guide Way Block

Working Pulley Shaft

Methodology



Design Calculation

1) Load acting on pipe (P):-

P=Mass of Upper Pulley

=Density of material × Volume of upper pulley(V)

V= area × thickness

$= \pi/4 \times D2 \times t - (\pi d/2)$

where

D= Diameter of pulley

t= Thickness of pulley

d= diameter of pipe

2). Design equation for chain drive

Here No. Of steps for design the chain drive

1). select the type of chain (Bush and roller chain)

2). find the no. of teeth on smaller sprocket from below table

	No. Of teeth at velocity ratio					
Sr. no	**1**	**2**	**3**	**4**	**5**	**6**
Bush roller chain	**31**	**27**	**25**	**23**	**21**	**17**

3). Chain Pitch is selected from below formula:-

$p = C1 \times (P \times k/z1 \times \omega 1 \times Pb \times x)^{(1/3)}$

where,

z1= No. Of teeth on driving sprocket

C1= 28 coefficient

P= load in KW

ω1=angular velocity of driving sprocket

= No. Of chain strands

Pb= allowable bearing pressure = upto 35N/ at n1 is upto 50 rev/mm

4). Force acting on driving shaft and FOS:-

F0= F+ Fc + Ff

where'

V= chain velocity in m/s

Fc =chain tension due to centrifugal of inertia =wv2 /g

w= weight per meter of chain length

Ff= Tensioning due to sagging=kf.w.c

Kf= coefficent to take into account the arrangement of chain drive.

Kf= 1.0, for vertical position.

Then ,

Fs= Fu/ F0

Fu= Breaking strength of chains .

= 106p2 N, p in mm for roller chain

- **5) Chain is checked for wear by unit pressure:-**
- Pb = F × V/A N/m
- k = load factor ,
- A =(dp × lb) × number of chain strands
- dp = diameter of joint pivot ,
- b = chain width ,
- lb = bush length=(bi + 2tp)
- **6). The force acting on the drive shaft :-**
- Fsh = F + 2kf × w × c

Deflection at center is given by, y = wl3 /48 EI

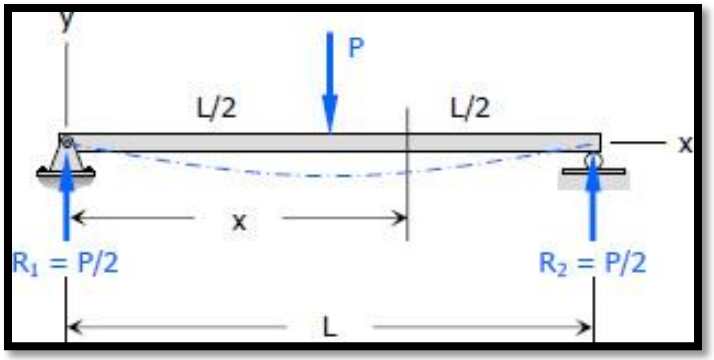


Figure:- Simply supported beam

Scope of Project

- In order to define the scope of a project, it is necessary to first establish the project objectives. The objective of a project may be to produce a new product, create a new service to provide within the organization. Automatic pipe bending machine is less costly comparing to hydraulic and pneumatic pipe bending machines and more accurate than manual pipe bending machine so Small industries as well as big manufacturer of various pipes. Bent pipe used as a structural member in vehicles and also used as a passageways in condenser, evaporator, water & gas line, drainage lines etc
- In nowadays, this type of automatic pipe bending machine is used in many different industries like automobile, aerospace, power plants and all mfg. industries etc
- Bent pipe used as a structural member in vehicles and also used as a passageways in condenser, evaporator, water & gas line, drainage lines etc.

Cost of Project

Sr.No	PARTS	COST
1.	3 – Pulley	1410
2.	Lead screw	450
3.	2 Chain Drive	870
4.	Guide Way	110
5.	Key Pad	180
6.	Transformer 3 –Amp	170
7.	2 Dc Motor	450
8.	Micro control Board	1000
9.	LCD Display	180
10.	Rectifier Circuit	80
11.	Micro controller I.C	70
12.	6 – Clamps	230
13.	Wooden board	230

Sr. No	PARTS	COST
14.	Wiring cost	50
15.	Main cable	20
16	Switch board	80
17.	Metal body	150
18.	Nut and Bolt	80
	Total Cost	**5810**

Conclusion

- Pipe bending is processes are used to make component for automobile, aerospace, households, power plant industries etc. Our pipe bending machine is automatic, Microcontroller based, less expensive light in weight in compare to other automatic machines so, it can be preferable for small industry holders, small workshop holders, in college institutes etc.

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