Project Overview

We have made a colour sorter machine which will identify between red, green and blue coloured coins and will automatically put them in box with three divisions, one for each. For this we have used RGB sensor in our project which after taking input about the colour passing by will rotate the motor accordingly which is connected to rack and pinion on which the box rests. This way the division of the box will align itself for the incoming colour.

We would like to thank our assigned TA Dharamveer sir for his constant help and support throughout the project which was very important for completion of this project. We would also like to thank other technical staffs present for helping us during project.

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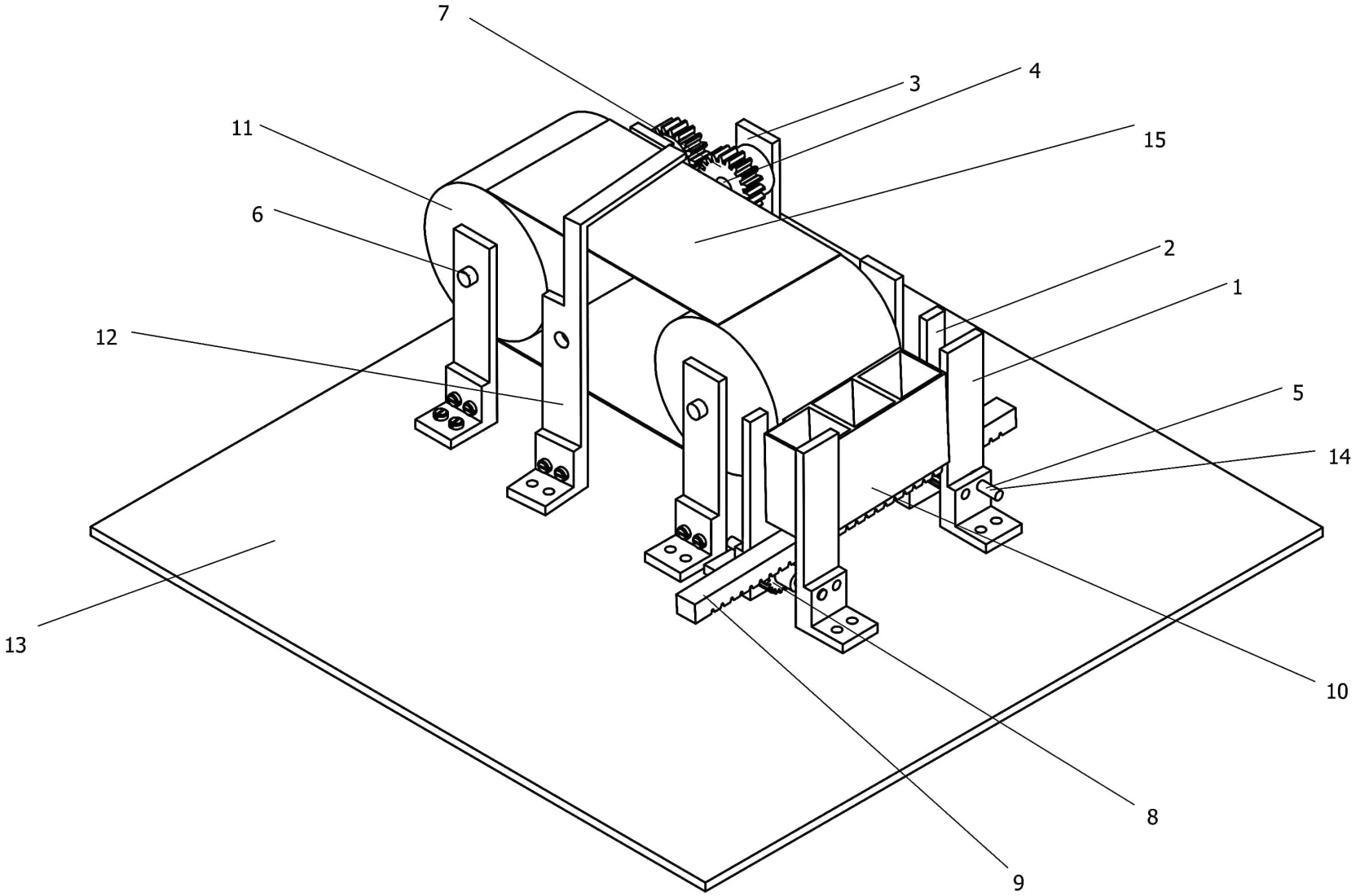
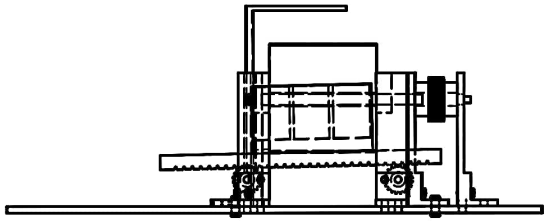
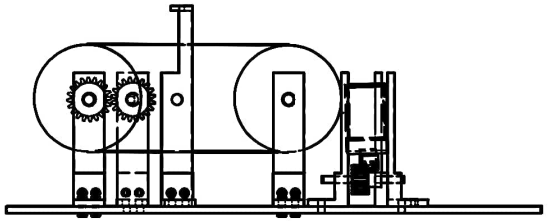
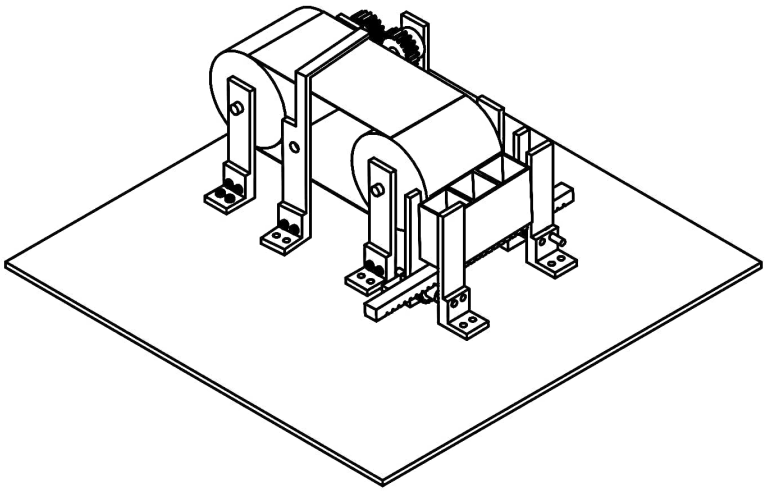
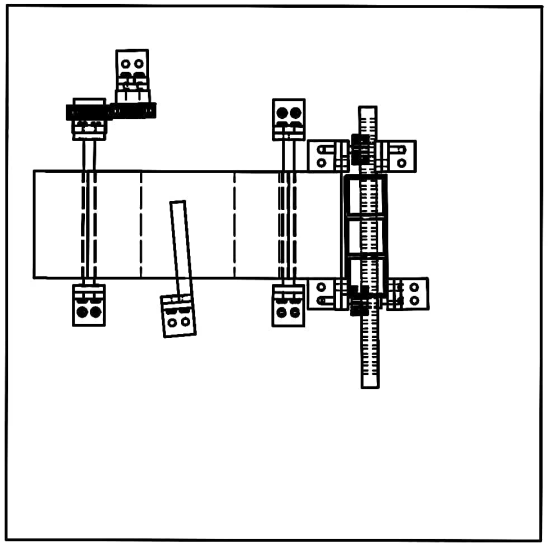


SCALE: 1:2	Designed by: Sidharth A S, Sirinxa Xavier, Surendra Prasad			Date 14-04-2024	
		Full model isometric			
				Edition	Sheet









Scale: 1:4	Drawing by: Sidharth A S, Sirinxa Xavier, Surendra Prasad			Date 14-04-2024	
		Full Model Orthographic			
		ffortho		Edition	Sheet 1 / 1

ARDUINO CODE

```
//assumption clockwise theta to be positive
//run test 1 changes required:
//for this we will need to introduce a previous color variable and need to caliberate the sensing output to show a particular color over the belt
//can caliberate the sensor to show values at a range as black and whenever the color is not black it moves the belt accordingly
//this way the belt will stop the object at the sensor
//the color caliberation for black over complete belt is required

#define S0_PIN 12
#define S1_PIN 13
#define S2_PIN 10
#define S3_PIN 11
#define OUT_PIN  9
int enA = 3;
int in1 = 4;
int in2 = 5;
int enB = 6;
int in3 = 8;
int in4 = 7;
int blue=0;  //assigning any arbitrary scale to map to the colors(the values were based on a random scale and were obtained after running the motor to detect different colors)
int red=255;
int green=-255;
float theta=0;

void rotate(float* theta, int color);
void clockwise(float* theta, int color);
void counterclockwise(float* theta, int color);
void brake(float* theta, int color);

void rotate(float* theta,int color){  //the rotate function will decide on the basis of color and theta regarding how much more the motor has to rotate
  if (color<*theta){
    clockwise(theta,color);
  }
  else if (color>*theta){
    counterclockwise(theta,color);
  }
  else{
    brake(theta,color);
  }
```

```
}

void brake(float* theta, int color){
  digitalWrite(in1, LOW); //USED TO BRAKE THE FLOW
  digitalWrite(in2, LOW);
}

void clockwise(float* theta,int color) {
  while(*theta>(color+26)){
    int startTime=millis();
    digitalWrite(in1, HIGH); // Direction for Motor A
    digitalWrite(in2, LOW);  // Direction for Motor A
    delay(100);
    int currentTime=millis();
    int time=currentTime-startTime;
    Serial.print(time);
    *theta-=time*0.255;
    Serial.println();
    Serial.print(*theta);
    Serial.println();
  }
  brake(theta,color);
  digitalWrite(in3,HIGH);
  digitalWrite(in4,LOW);
  delay(3000);//after detecting a particular color and moving according to it we have stopped the
motor A , giving the block time to come and fall into it.
}

void counterclockwise(float* theta,int color) {
  while(*theta<(color-26)){
    int startTime=millis();  //used to get an idea of how much the motor has moved
    digitalWrite(in1, LOW); // Direction for Motor A
    digitalWrite(in2, HIGH);  // Direction for Motor A
    delay(100);
    int currentTime=millis();
    int time=currentTime-startTime;
    Serial.print(time);
    *theta+=time*0.255;
    Serial.println();
    Serial.print(*theta);
    Serial.println();
  }
  brake(theta,color);
  delay(3000);
```

```
  loop();
}

void setup() {
  pinMode(S0_PIN, OUTPUT);
  pinMode(S1_PIN, OUTPUT);
  pinMode(S2_PIN, OUTPUT);
  pinMode(S3_PIN, OUTPUT);
  pinMode(enA, OUTPUT);
  pinMode(enB, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  // Set OUT_PIN as Input
  pinMode(OUT_PIN, INPUT);
  // Set Pulse Width scaling to 20%
  digitalWrite(S0_PIN, HIGH);
  digitalWrite(S1_PIN, LOW);
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  //motor speed settings
  analogWrite(enA, 255); // Speed for Motor A (0-255)
  analogWrite(enB, 255); // Speed for Motor B (0-255)
  digitalWrite(in3, HIGH); // Direction for Motor B
  digitalWrite(in4, LOW);  // Direction for Motor B
  Serial.begin(9600); // Initialize serial communication
}

void loop() {
  int r, g, b;
  r = process_red_value();
  g = process_green_value();
  b = process_blue_value();
  Serial.print("r = ");
  Serial.print(r);
  Serial.print(" ");
  Serial.print("g = ");
  Serial.print(g);
  Serial.print(" ");
  Serial.print("b = ");
  Serial.print(b);
  Serial.print(" ");
  Serial.println();
```

```
  if ((r>150)&&(b>150)&&(g>150)){
    Serial.print('black');
  }
  else{
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);     //stops the belt as soon as the color changes from black
    if (r<g && r<b){
    Serial.print("red ");
    rotate(&theta,red);
    }
    else if (g<r && g<b){
      Serial.print("green ");
      rotate(&theta,green);
    }
    else{
      Serial.print("blue ");
      rotate(&theta,blue);
    }
    Serial.print("");
    }
}

int process_red_value() {
  digitalWrite(S2_PIN, LOW);
  digitalWrite(S3_PIN, LOW);
  int pulse_length = pulseIn(OUT_PIN, LOW);
  return pulse_length;
}

int process_green_value() {
  digitalWrite(S2_PIN, HIGH);
  digitalWrite(S3_PIN, HIGH);
  int pulse_length = pulseIn(OUT_PIN, LOW);
  return pulse_length;
}

int process_blue_value() {
  digitalWrite(S2_PIN, LOW);
  digitalWrite(S3_PIN, HIGH);
  int pulse_length = pulseIn(OUT_PIN, LOW);
  return pulse_length;
}
```

CALCULATION (RACK)

1. Module = Pitch Diameter / No of teeth
2. Addendum = Module
3. Dedendum = 1.157 x Module
4. Whole Depth = 2.157 x Module
5. Pitch Pitch Diameter = Module x No of teeth
6. Outside Diameter = Module x (No of teeth + 2)
7. Linear Pitch = π x Module

No.	Item	Symbol	Value
1	Normal Module	m_n	1.5
2	No of teeth	z	20
3	Linear Pitch	p_{rack}	4.71
4	Pinion Pitch diameter	d_{pinion}	33
5	Rack Pitch Distance	d_{rack}	3.2

All length dimensions are in mm.

CALCULATION (SPUR GEAR & PINION)

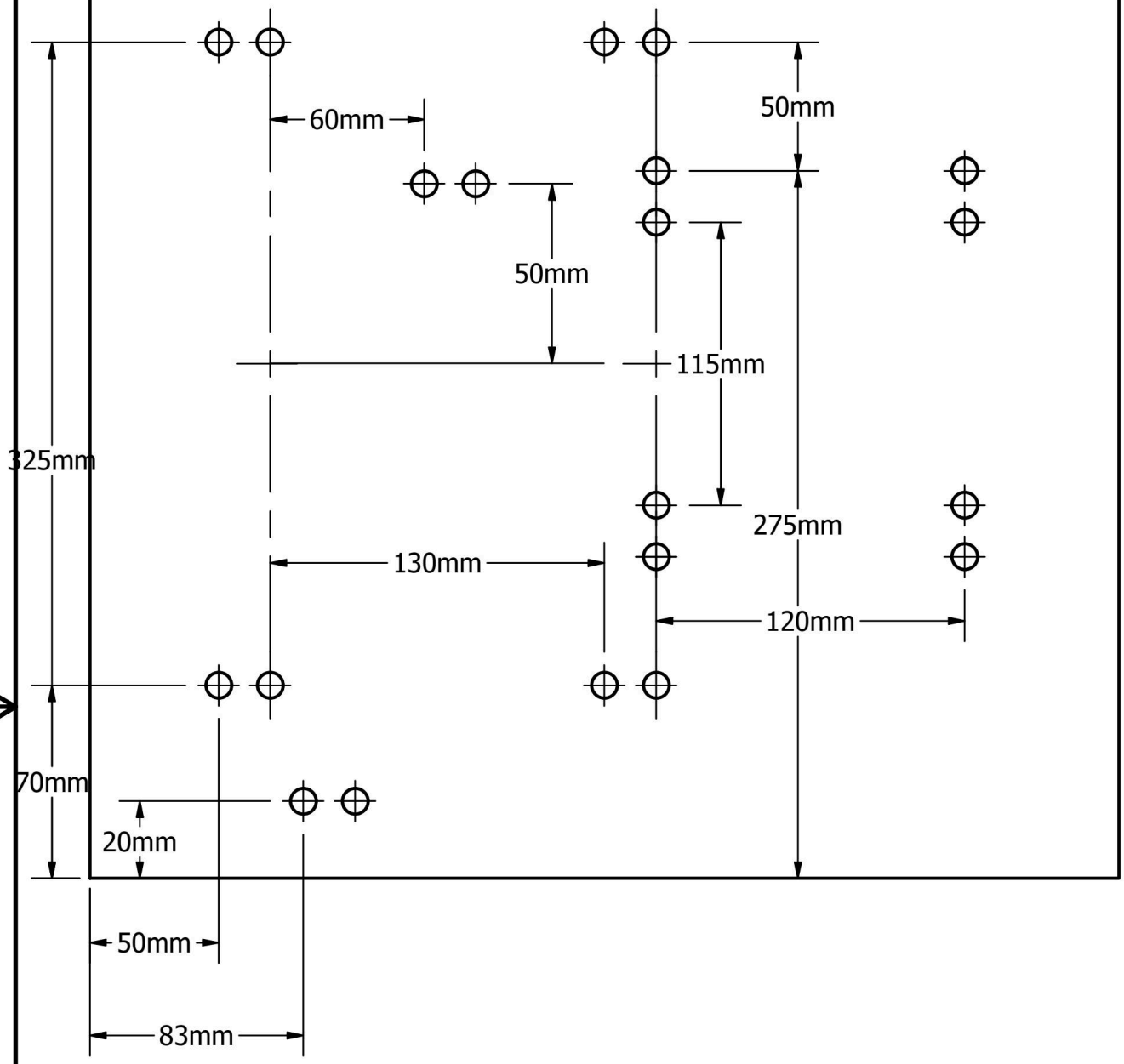
1. Module = Pitch Diameter / No of teeth
2. Addendum = Module
3. Dedendum = 1.157 x Module
4. Whole Depth = 2.157 x Module
5. Pitch Diameter = Module x No of teeth
6. Outside Diameter = Module x (No of teeth + 2)

No.	Item	Symbol	Value
1	Normal Module	m_n	1.5
2	Addendum	h_a	1.5
3	Pitch Diameter	d_1	30
4	No of teeth	z	20
5	Dedendum	h_d	17.35
6	Whole depth	h	32.35
7	Outside Diameter	d_{a1}	33

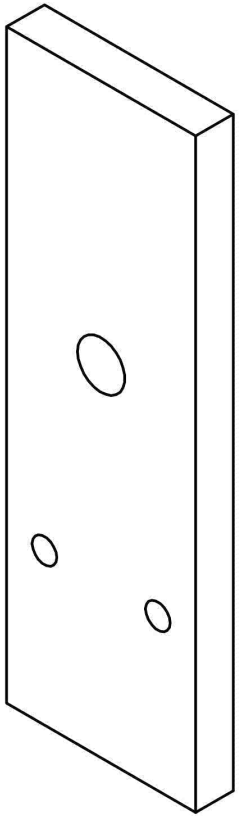
All length dimensions are in mm.

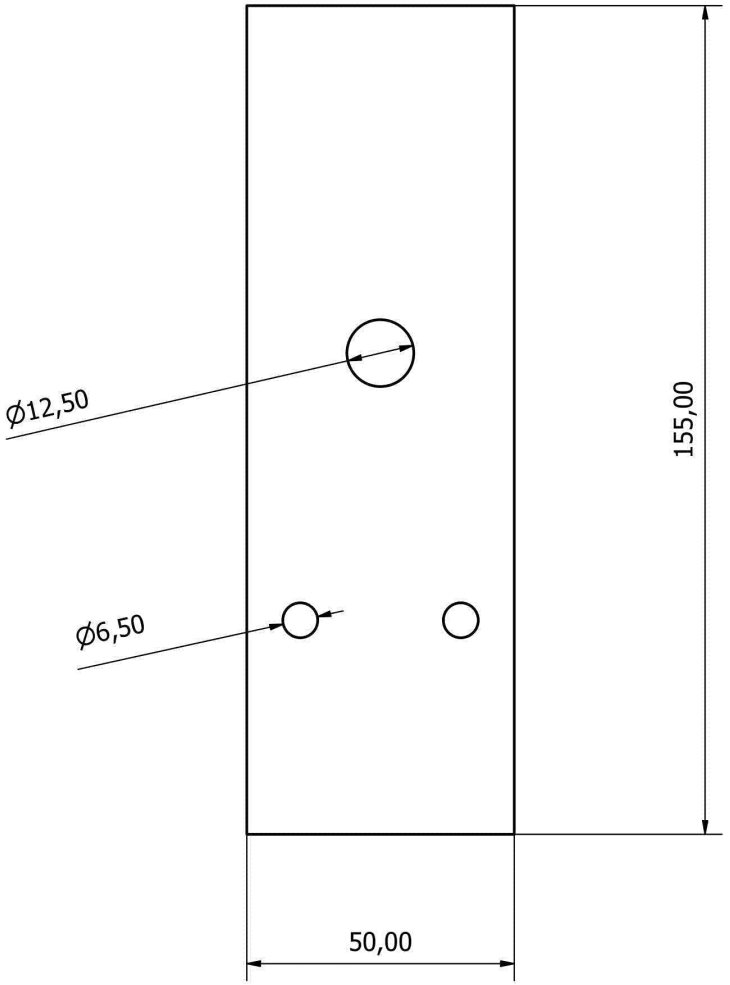
LIST OF PARTS

Part Name	Quantity	Material	Manufactured/Bought	Machining operations
BASE PLATE	1	Mild Steel	Manufactured	Drilling
L CLAMP	10	Mild Steel	Manufactured	Drilling
COLLECTOR BOX	3	PLA	Manufactured	3-D Printing
ROLLER	1	Mild Steel	Manufactured	Lathe/Turning and Facing
SHAFT	2	Mild Steel	Manufactured	
GEAR	2	Mild Steel	Manufactured	Milling and Lathe
RACK	1	Mild Steel	Manufactured	Milling
PINION	2	Mild Steel	Manufactured	Milling and Lathe
SHAFT (big)	3	Mild Steel	Manufactured	
DC MOTOR	2	NA	Bought	NA
RGB SENSOR	1	NA	Bought	NA



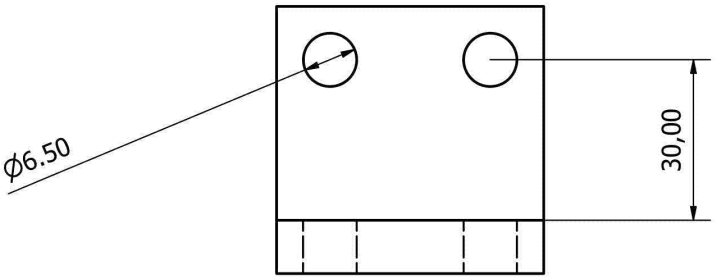
CREDIT - SOORYANSH	PART NUMBER - 4
INSTRUCTOR - Niraj Sinha	PART NAME - Base plate
GUIDE - Dharamveer Sir	SCALE - 1/2.5
REMARKS -	

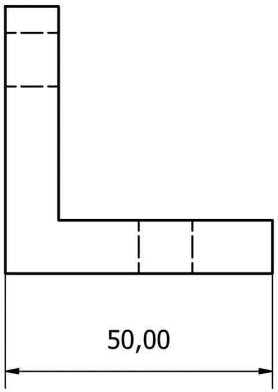


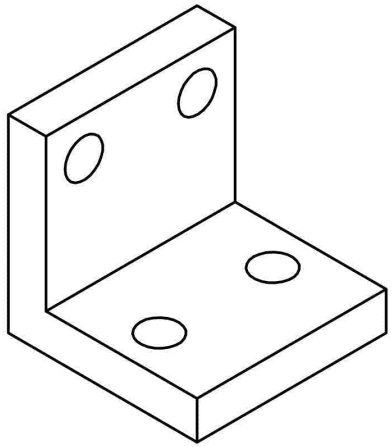


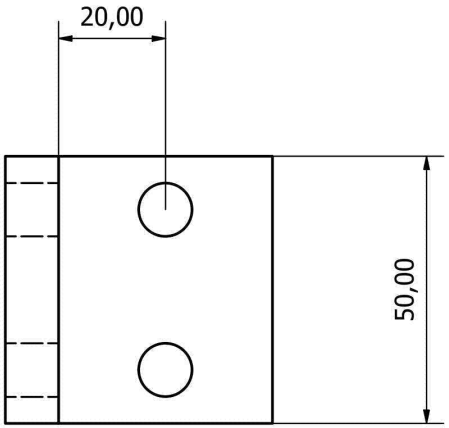
ALL DIMENSIONS ARE IN MM

SCALE: 1:1	Material: Mild steel	Date		Date 14-04-2024	
Designed by: Sidharth, Surendra, Simran, Sirinxa, Soham Drawing by: Sidharth	Part 1: L-Clamp face type 1				
	ffplate1		Edition	Sheet	

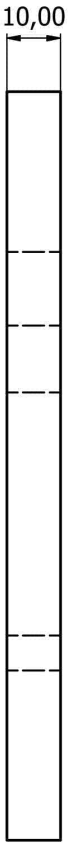


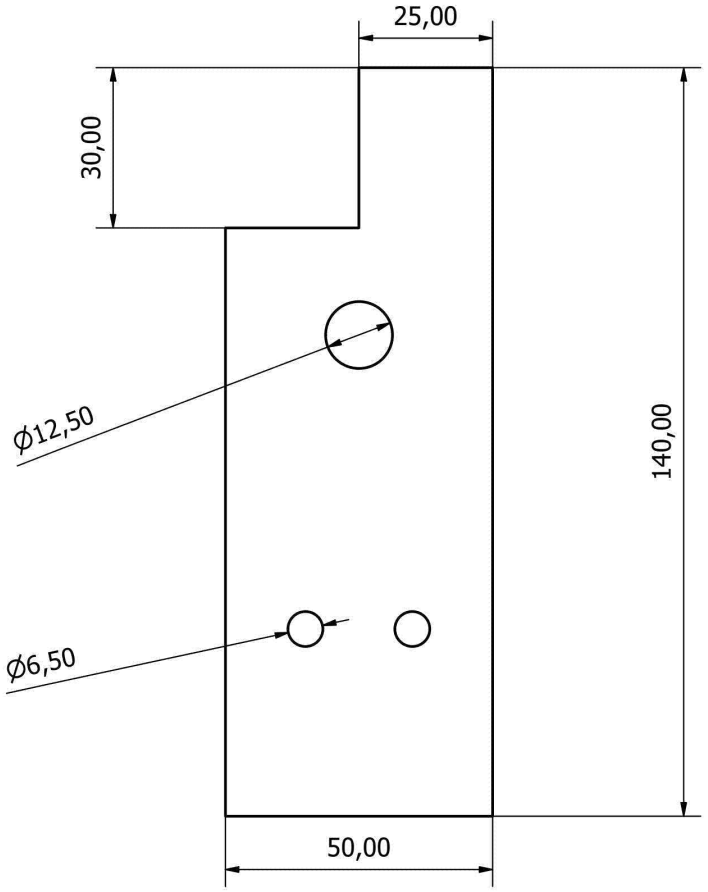


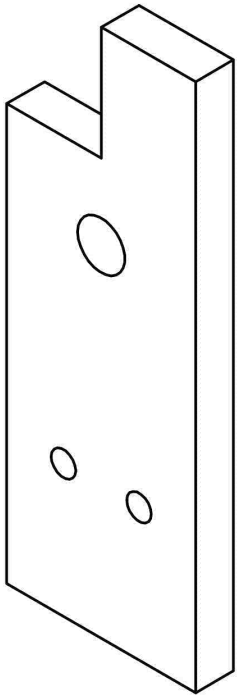


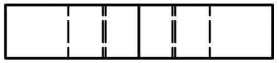


Designed by Sidharth, Surendra, Simran, Sirinka, Soham				SCALE 1:1 Material Used: Mild Steel	
	1. L-clamp type 1 angle				
	ffangle1			Edition	Sheet 1 / 1



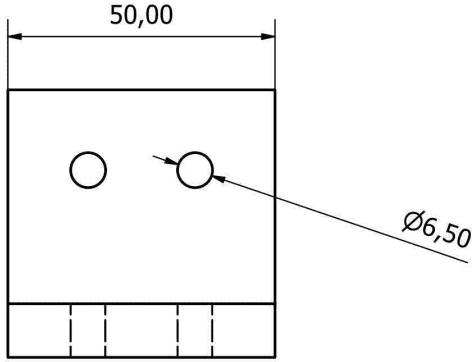


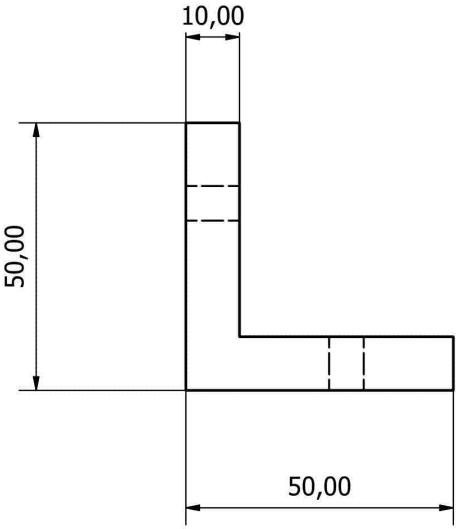


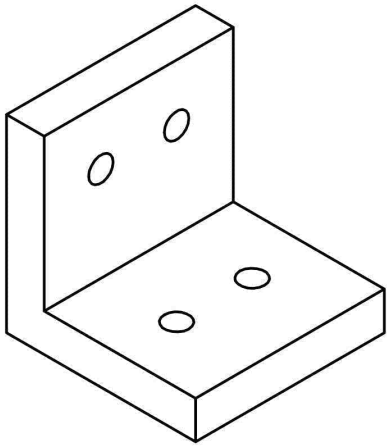


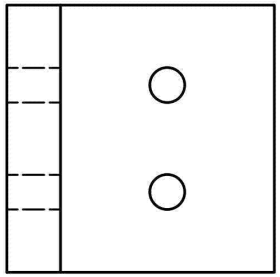
ALL DIMENSIONS IN MM

Designed by Sidharth, Surendra, Simran, Sirinka, Soham			Date	SCALE 1:1	
				Material used: Mild Steel	
		2. L-clamp type 2 plate			
		ffplate2		Edition	Sheet 1 / 1

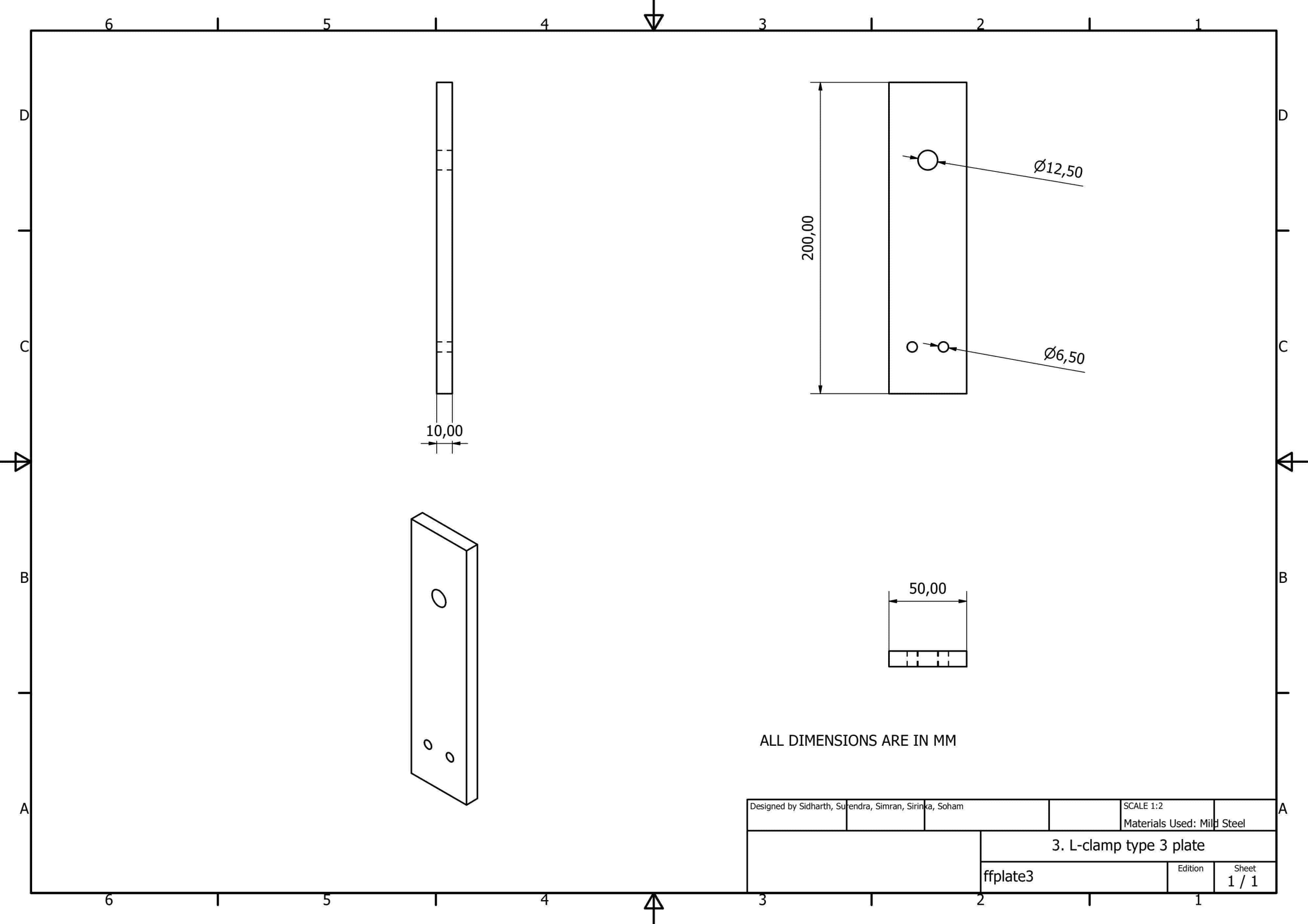








Designed by Sidharth, Surendra, Simran, Sirinka, Soham				SCALE 1:1 Material Used: Mild Steel	
	2. L-clamp type 2 angle				
	ffangle2		Edition	Sheet 1 / 1	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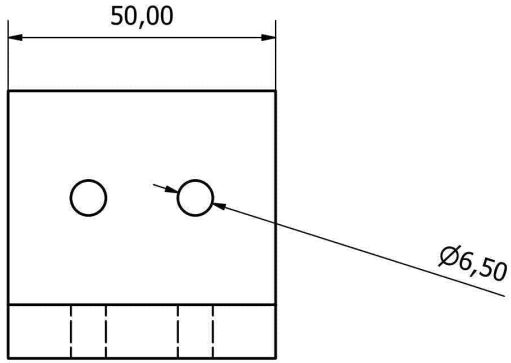
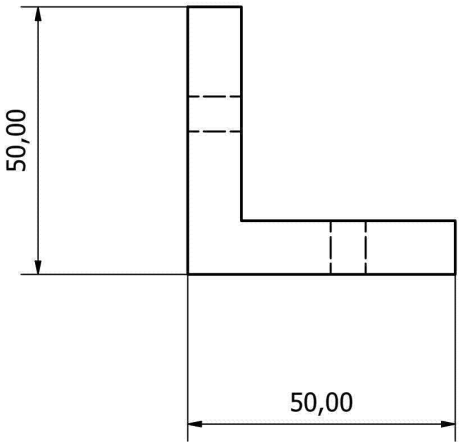
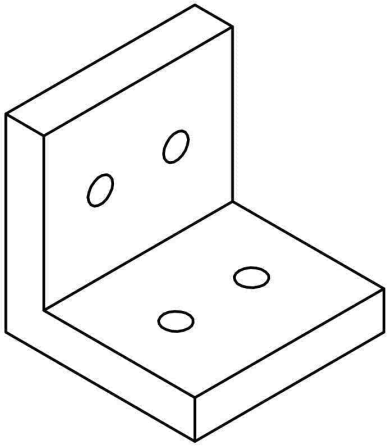
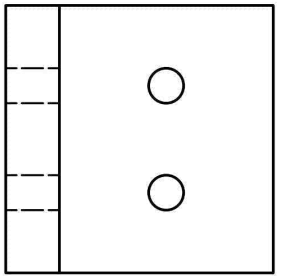
50,00
ALL DIMENSIONS ARE IN MM
Designed by Sidharth, Surendra, Simran, Sirinka, Soham
SCALE 1:2
Materials Used: Mild Steel
3. L-clamp type 3 plate
ffplate3
Edition
Sheet
1 / 1



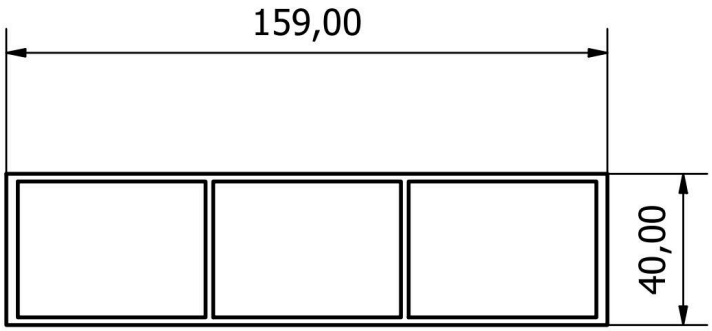


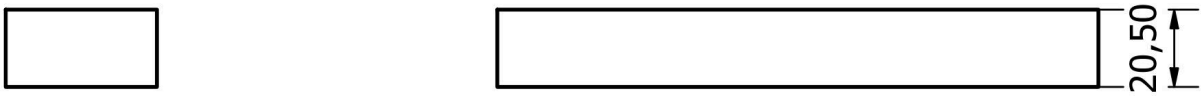


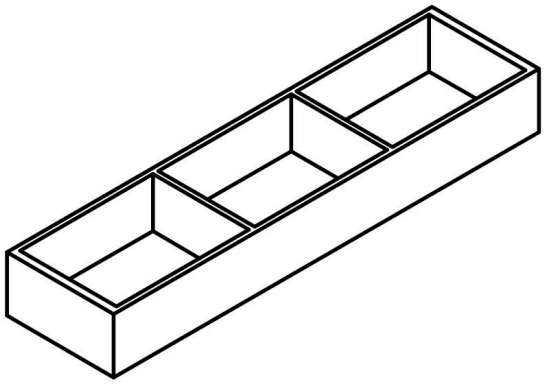


ALL DIMENSIONS IN MM

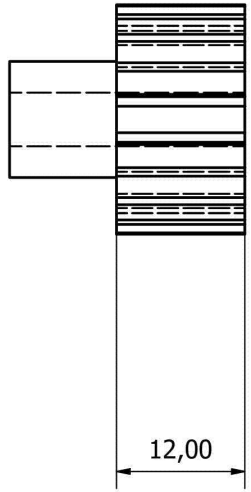
Designed by Sidharth, Surendra, Simran, Sirinka, Soham				SCALE 1:1 Material used: Mild Steel	
	3. L-clamp type 3 angle				
	ffangle3			Edition	Sheet 1 / 1

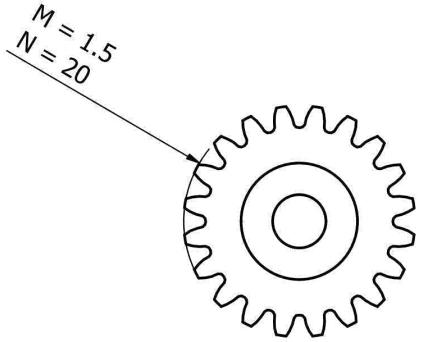


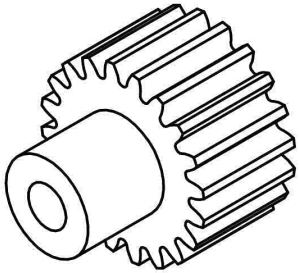


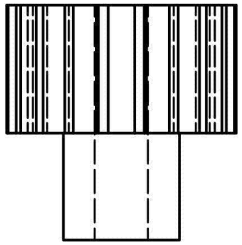


CREDIT	INSTRUCTOR	GUIDE			
Sirinxa Xavier	Niraj Sinha	Dharamveer Sir			



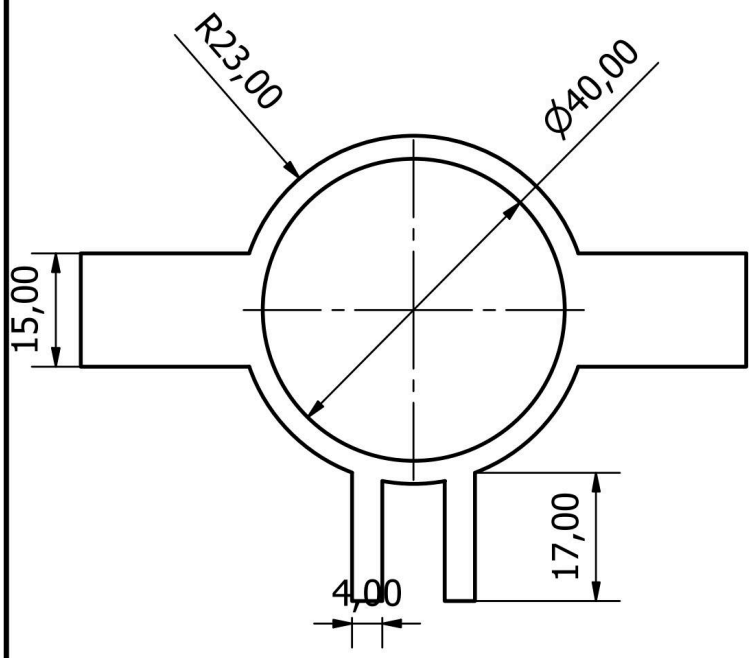


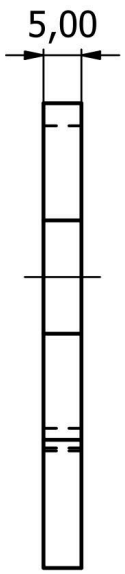


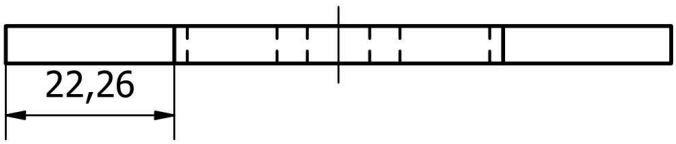


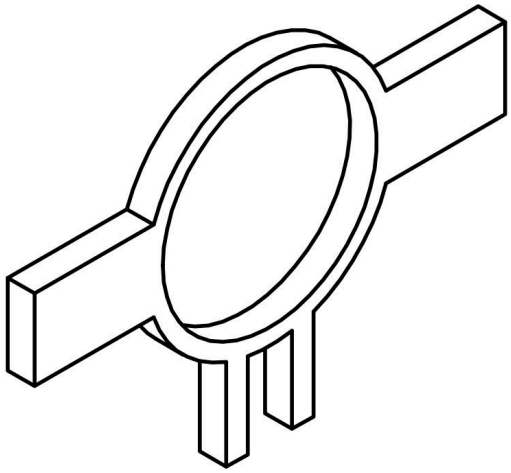
ALL DIMENSIONS ARE IN MM

		Material: Mild Steel		Scale: 2:1 13-02-2024	
Designed By: Surendra Prasad, Sidharth A S			PART 7: GEAR		
			GROUP 9	Edition	

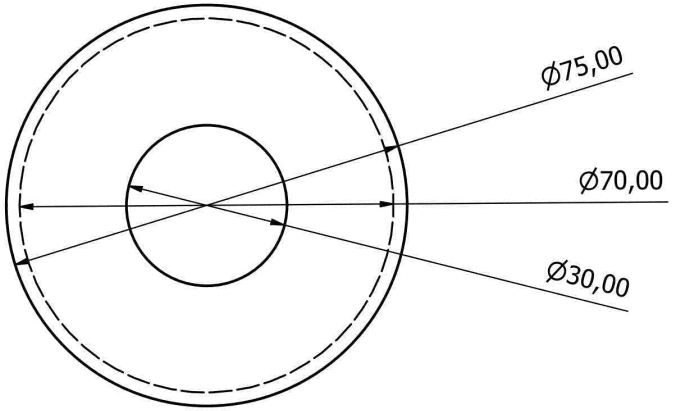


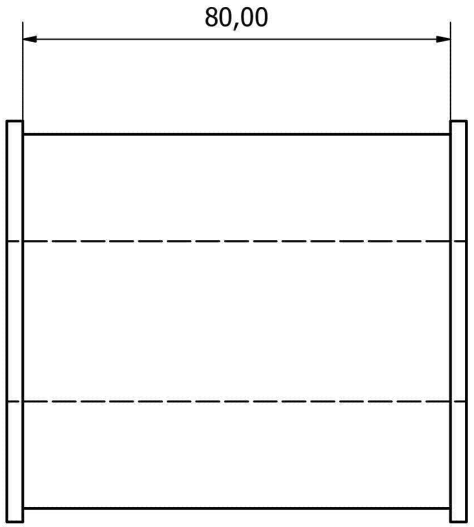


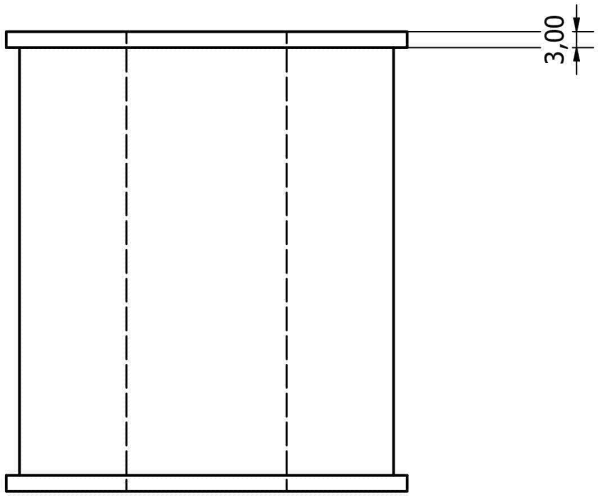


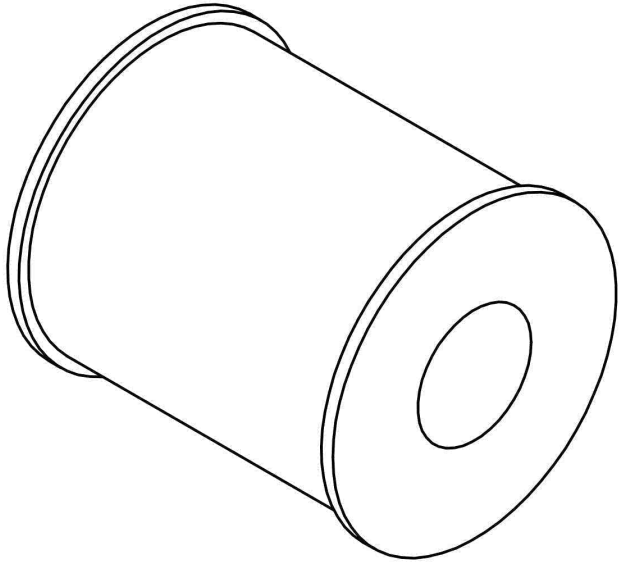


CREDIT	INSTRUCTOR	GUIDE			
Sirinxa Xavier	Niraj Sinha	Dharamveer Sir			
REMARKS					



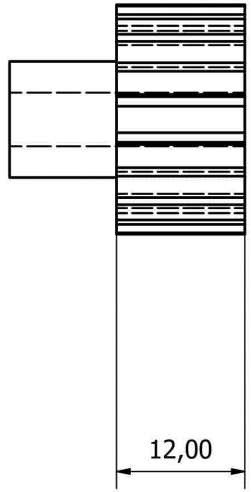


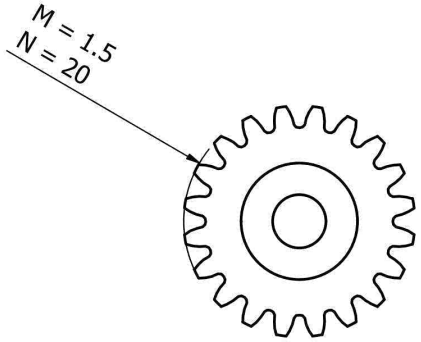


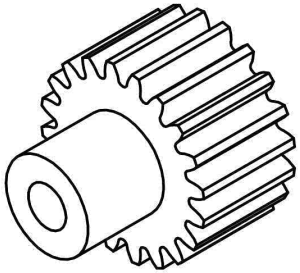


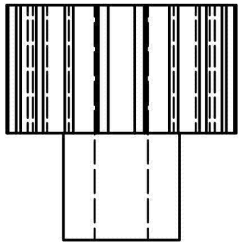
ALL DIMENSIONS ARE IN MM

Designed by Sidharth A S	Guide: Mr. Dharmveer Kumar	Instr.: Dr. Niraj Sinha		Scaale: 1:2 13-02-2024	
	PART 4: CONVEYOR BELT				
	GROUP 9			Edition	Sheet



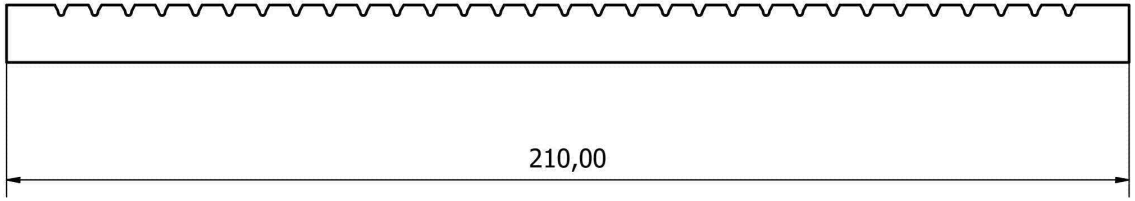




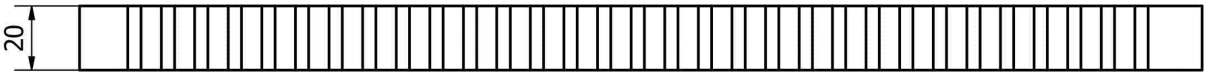


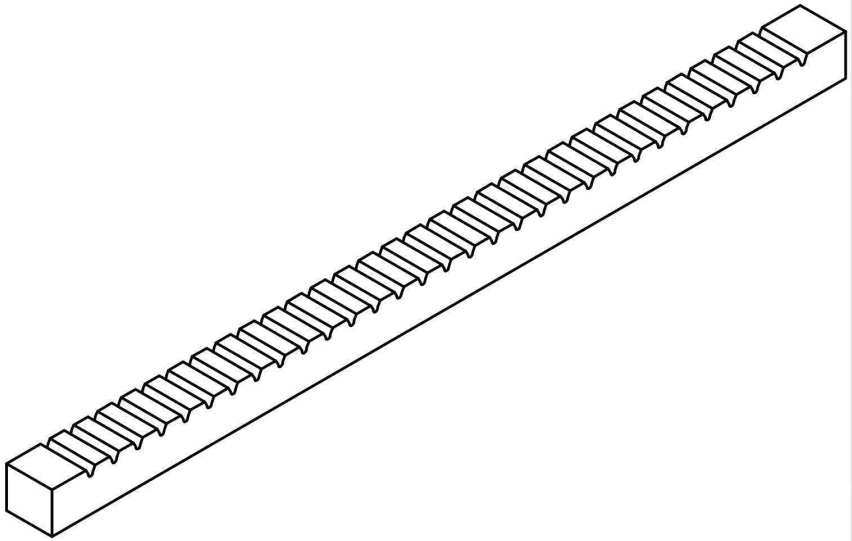
ALL DIMENSIONS ARE IN MM

		Material: Mild Steel		Scale: 2:1 13-02-2024	
Designed By: Surendra Prasad, Sidharth A S			PART 8: PINION		
			GROUP 9	Edition	

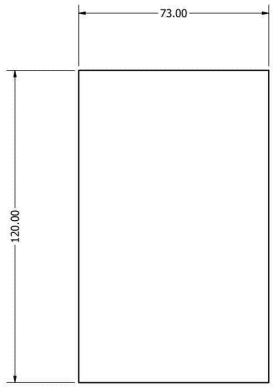


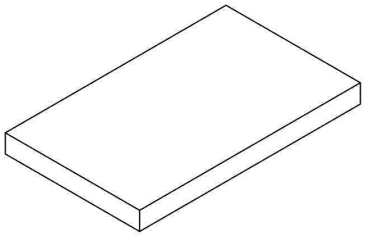
M=1.5
Pitch = 4.7 mm
Depth = 3.2 mm

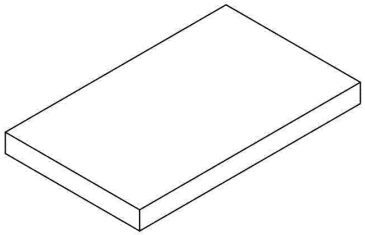


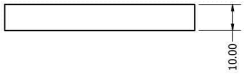


Guide: Mr. Dharmveer Kumar		Instr.: Dr. Niraj Sinha Date		Scale: 1:1	
Designed by Sidharth A S, Surendra Prasad		ALL DIMENSIONS IN MM			
		Part 7: Rack	Edition	Sheet 1 / 1	



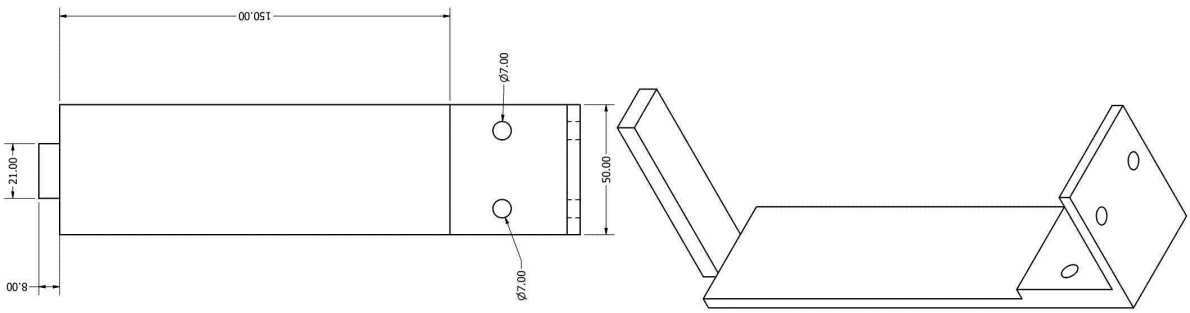


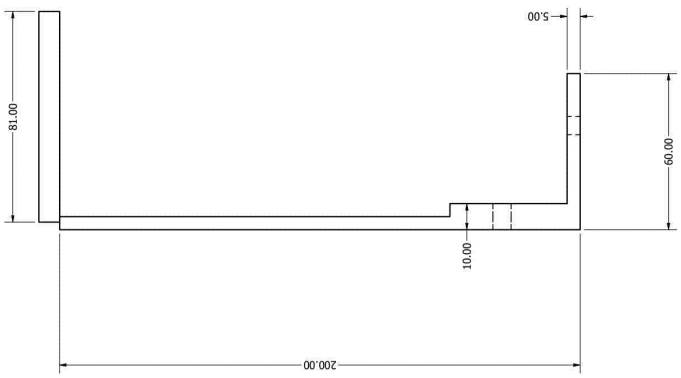


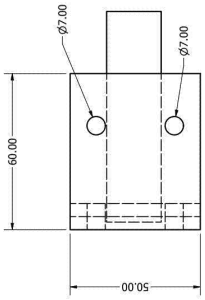


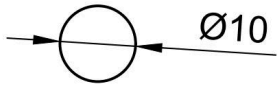
DRAWN surendra , soham	15-04-2024	Group 9	
CHECKED			
QA		TITLE Part 15	
MFG Rubber tube			
APPROVED		SIZE D	DWG NO belt REV
		SCALE 1 : 1	SHEET 1 OF 1

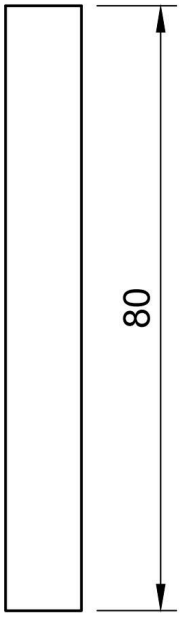
DRAWN	surendra , simran		Group 9
CHECKED			
QA			
MFG	Mild steel		Part 12
APPROVED			
	15-04-2024	TITLE	
SIZE	DWG NO		REV
D	sensor_holder		
SCALE	1 : 1	SHEET 1 OF 1	



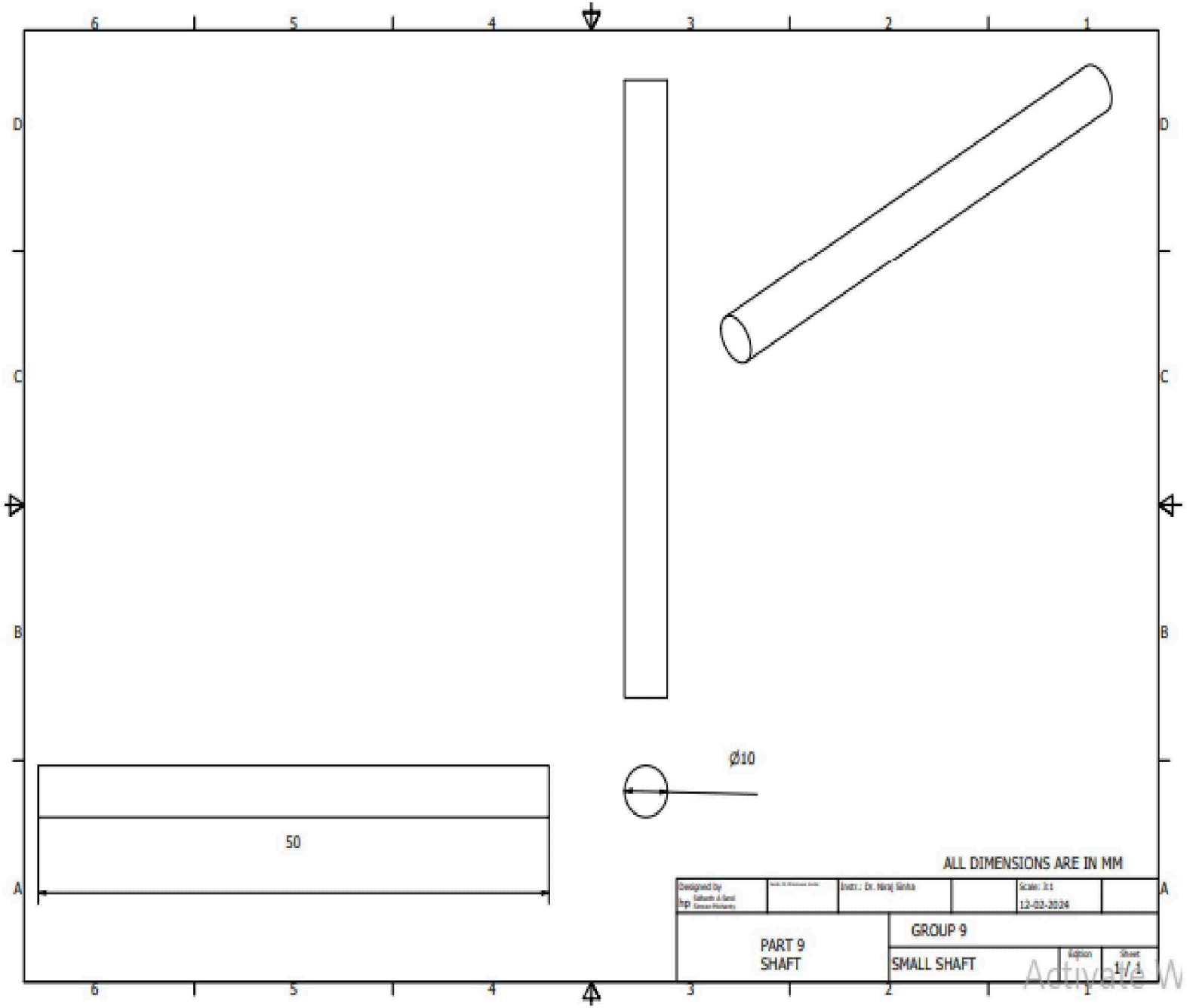








Dept.	Technical reference	Created by Simran Mohanty	Approved by	
		Document type	Document status	
		Title shaft	DWG No.	
			Rev. / Date of issue	Sheet 1/1


6
5
4
3
2
1
D
C
B
A
Ø10
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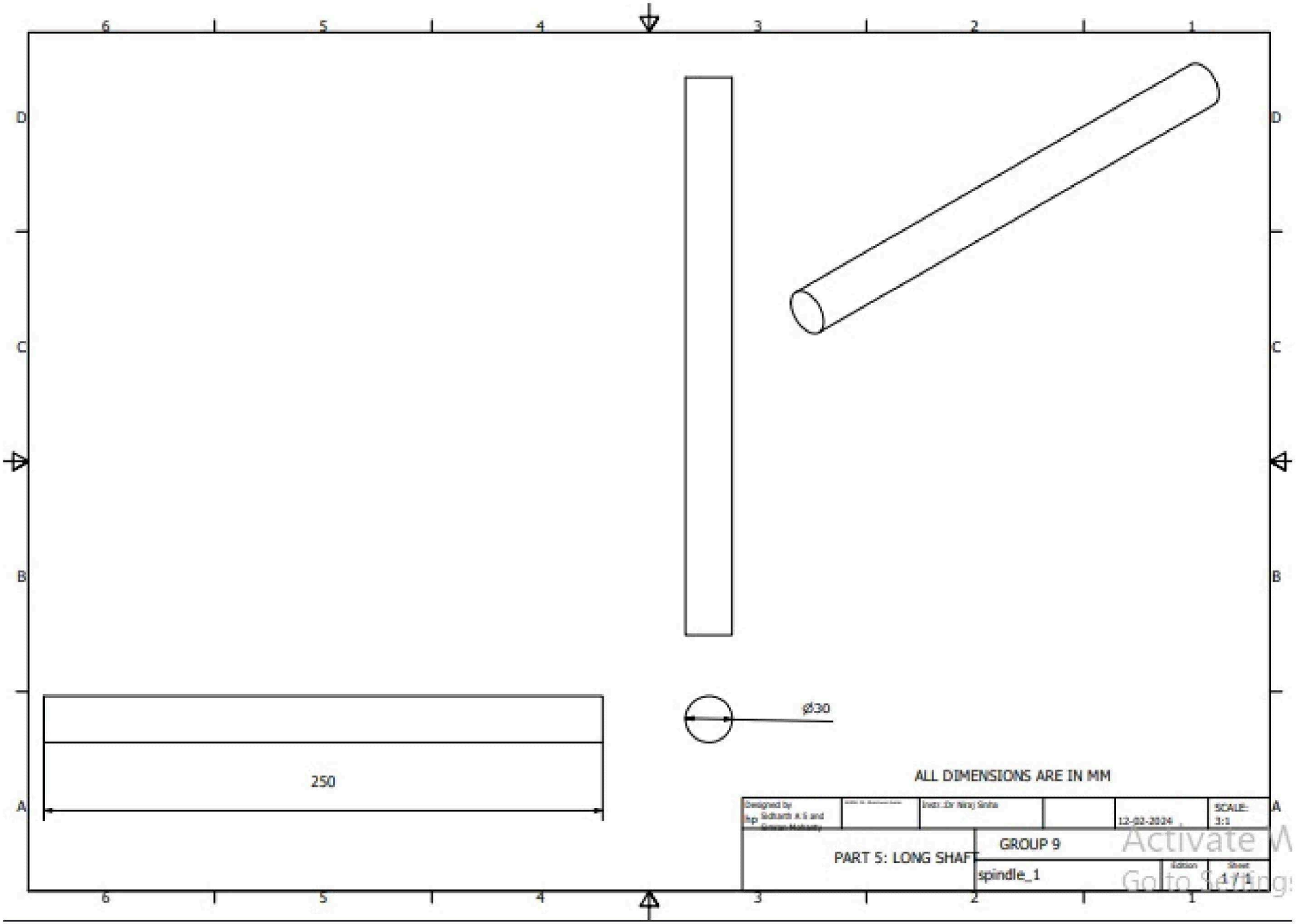
ALL DIMENSIONS ARE IN MM
Designed by
Instr.: Dr. Niraj Sinha
Scale: 2:1
12-02-2024
PART 9
SHAFT
GROUP 9
SMALL SHAFT
Edition
Sheet
1 / 1


6
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ALL DIMENSIONS ARE IN MM
Designed by
Sidharth A S and
Instr.:Dr Niraj Sinha
12-02-2024
SCALE:
3:1
GROUP 9
PART 5: LONG SHAFT
spindle_1
Edition
Sheet
1 / 1

Cost Analysis

- MATERIAL COST:

Name of part	Cost/kg (₹)	Weight (kg)	Total cost (₹)
L-Clamp	100	9.5	950
Shafts	100	2	200
Base plate	100	16.5	1,650
Rack and Pinion	100	0.75	75
Gears(x2)	100	0.25	25
Total			**2,900**

- Parts Manufacturing Cost:

Manufacturing process	Part Name	Machine rates(₹/hr)	Total working time(min)	Total cost (₹)
Drilling	Base plate	75	40	50
	L-clamps	75	60	75
	shafts	75	20	25
	Total:			**150**
Turning	Shafts	150	40	100
	Rack	150	30	75
	Gears(x4)	150	210	525
	Total:			**700**

Milling	Rak	250	60	250
	Gears(x4)	250	90	375
	Total:			**625**
3D-Printing	Box	100	240	400
Total cost:				**1,875**

➢ Electrical Part Cost:

Part Name	Cost (₹)
Electric Kit	1000
RGB Sensor	400
Total:	**1,400**

❖TOTAL PROJECT COST:-

Material cost	2900
Parts Manufacturing cost	1875
Electrical Parts cost	1400
TOTAL:	**6,175**

Total Estimated Cost of Project = ₹6,175