

German University in Cairo

Mechatronics Lab (MCTR704)

Metal Separation

Project No. [22]

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Table of Contents

Milestone No. / submission date	Content	Page
1 / Before (13/10/22)	Project Description	3
1 / Before (13/10/22)	Solid works Design: 3D Schematic Diagram	4
2 / Before (27/10/22)	Mechanical Components in 2D with Dimensions	5
2 / Before (27/10/22)	Mechanical Components List	11
2 / Before (27/10/22)	Pneumatic Circuit	12
2 / Before (27/10/22)	Step Diagram	13
3 / Before (24/11/2022)	Hardware Model	14
4 / Final (27/10/22)	Pneumatic Step Diagram and Description	15
4 / Final (27/10/22)	Controller Operating Panel Classic Control implementation Project hardware fully operated	Vid

Project Description

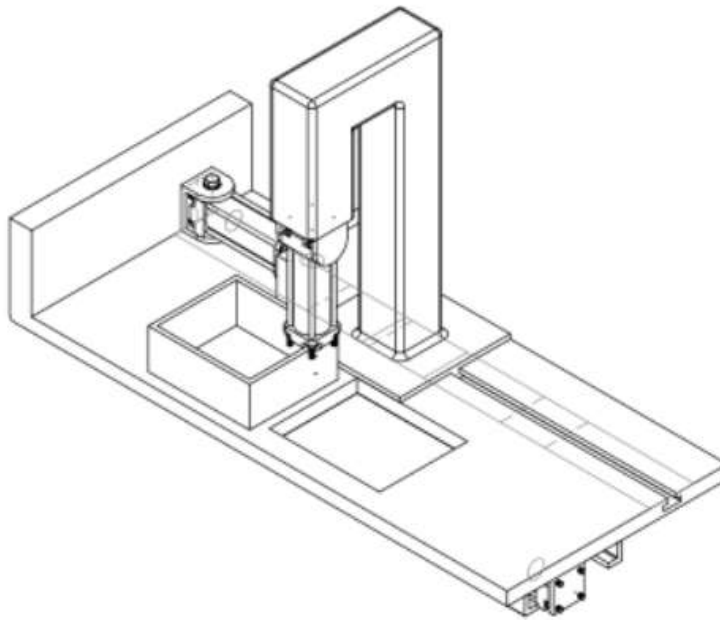
The main objective of this project is to separate metallic materials from non-metallic ones by integrating electronics and pneumatics.

A vertical cylinder with a magnet (or an electro-magnetic piece) attached to it is used to pick up the metallic pieces from a pile of objects. Once done, a double horizontal cylinder, which is initially extended, is then retracted to move the frame of the vertical cylinder towards a collecting box. The collecting box bottom has attraction force higher than that of the electro-magnetic piece to attract the metallic materials. Simultaneously, cylinder number three, which is initially extended as well, is retracted horizontally moving the base and releasing the non-metallic materials so that another pile could be brought to be sorted.

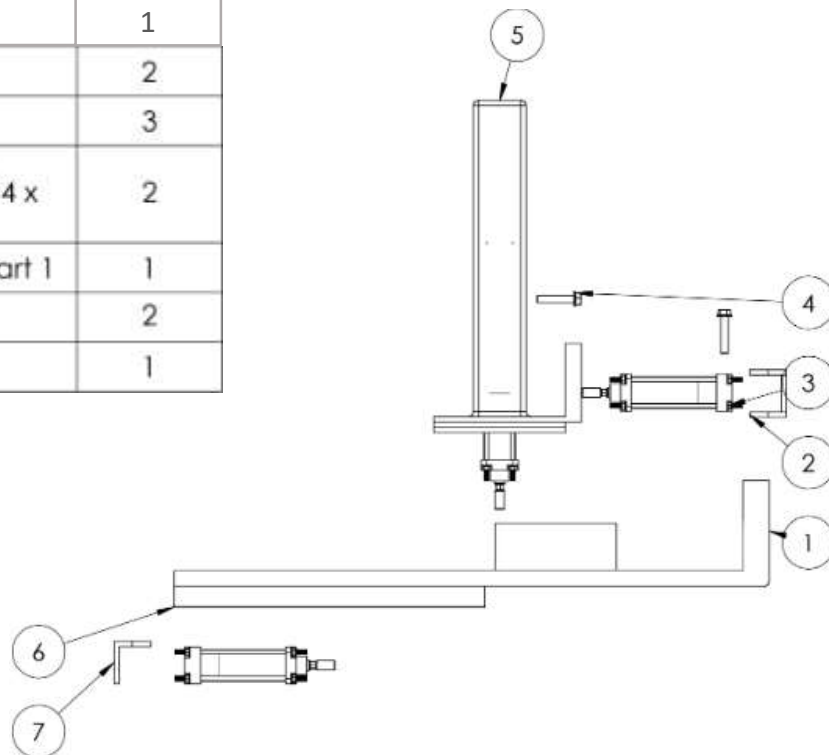
The components used are as follows;

- ☐ 3 double-acting cylinders
- ☐ 6 reed switches
- ☐ 10 relays
- ☐ 6 valves
- ☐ Electro-magnet/Magnet

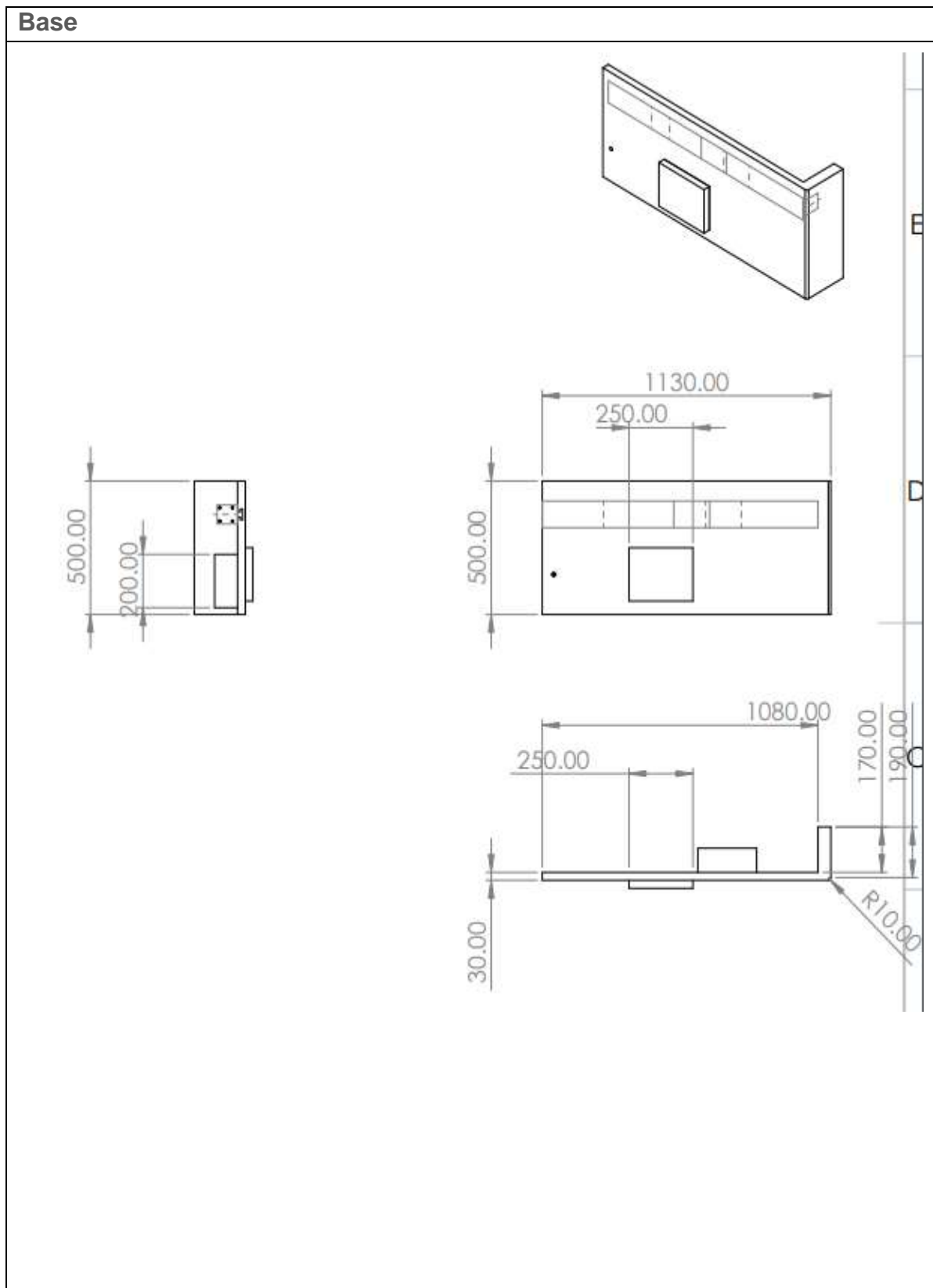
Solid works Design: 3D Schematic Diagram



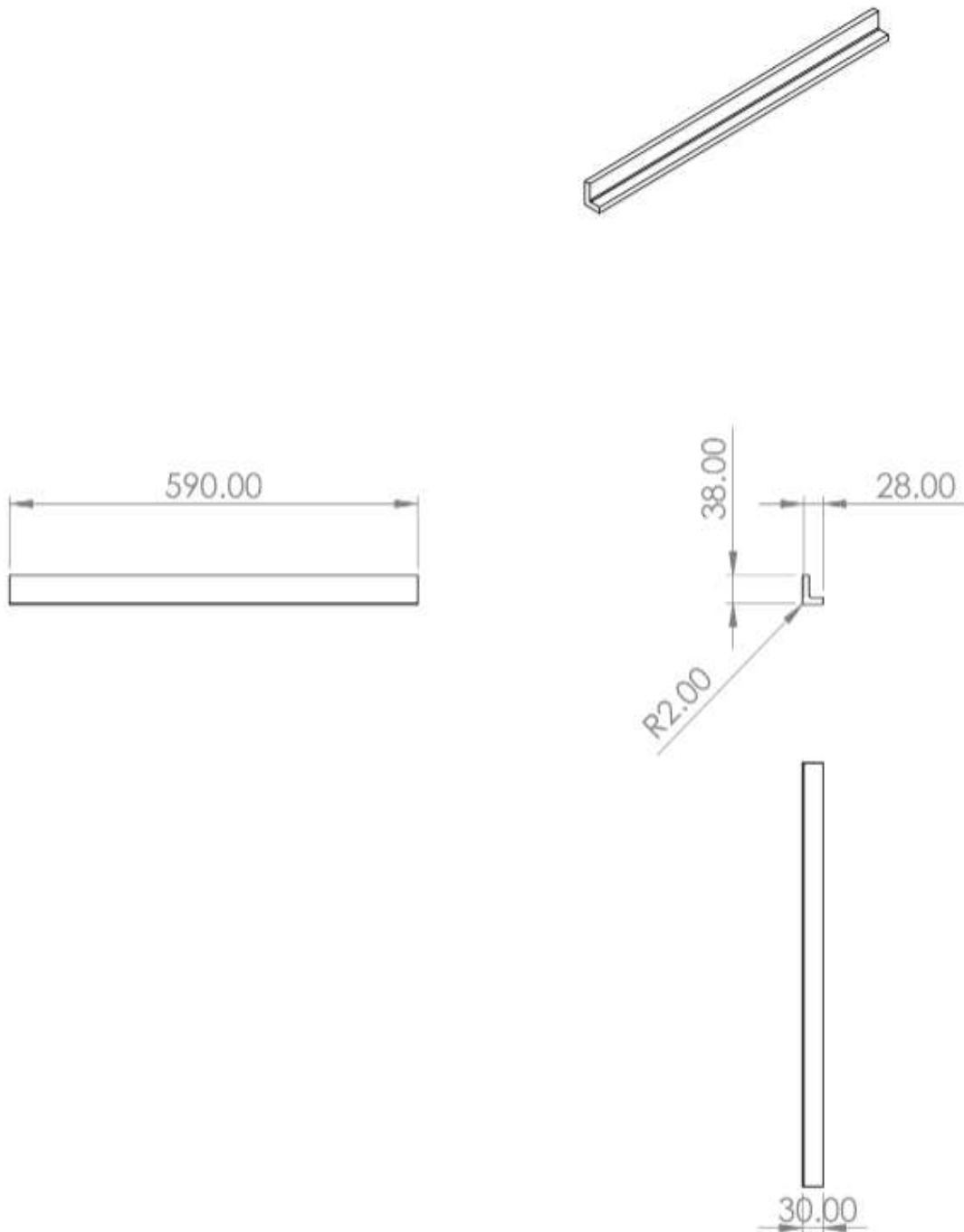
1	base	1
2	bracket	2
3	Assem1	3
4	B18.2.3.4M - Hex flange screw, M14 x 2.0 x 70 --34N	2
5	Main Frame 2 - Part 1	1
6	support	2
7	bracket 2	1



Mechanical Components 2D Projections with Dimensions



Support



Main Frame

Technical drawing of a Main Frame assembly, showing three views: Front View, Top View, and Isometric View. The drawing includes dimensions in millimeters (mm).

Front View Dimensions:

- Overall width: 600.00
- Inner width: 580.00
- Height of the main frame: 250.00
- Height of the base: 80.00
- Height of the base: 100.00

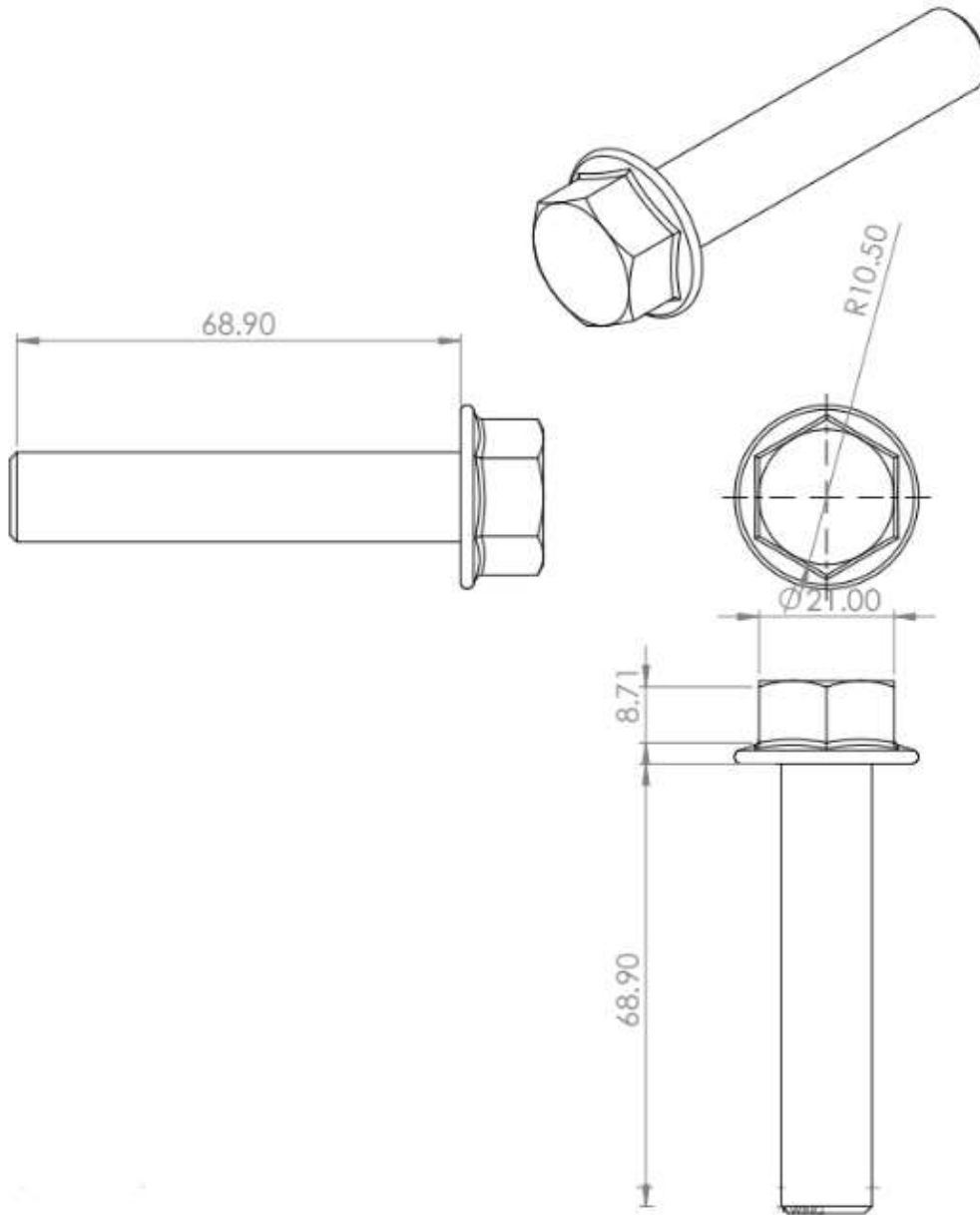
Top View Dimensions:

- Overall width: 310.00
- Inner width: 250.00
- Height of the main frame: 280.00
- Height of the base: 80.00
- Radius: R20.00
- Width of the base: 300.00
- Width of the base: 280.00
- Height of the main frame: 260.00
- Height of the base: 100.00
- Height of the base: 150.00
- Height of the base: 600.00
- Height of the base: 580.00

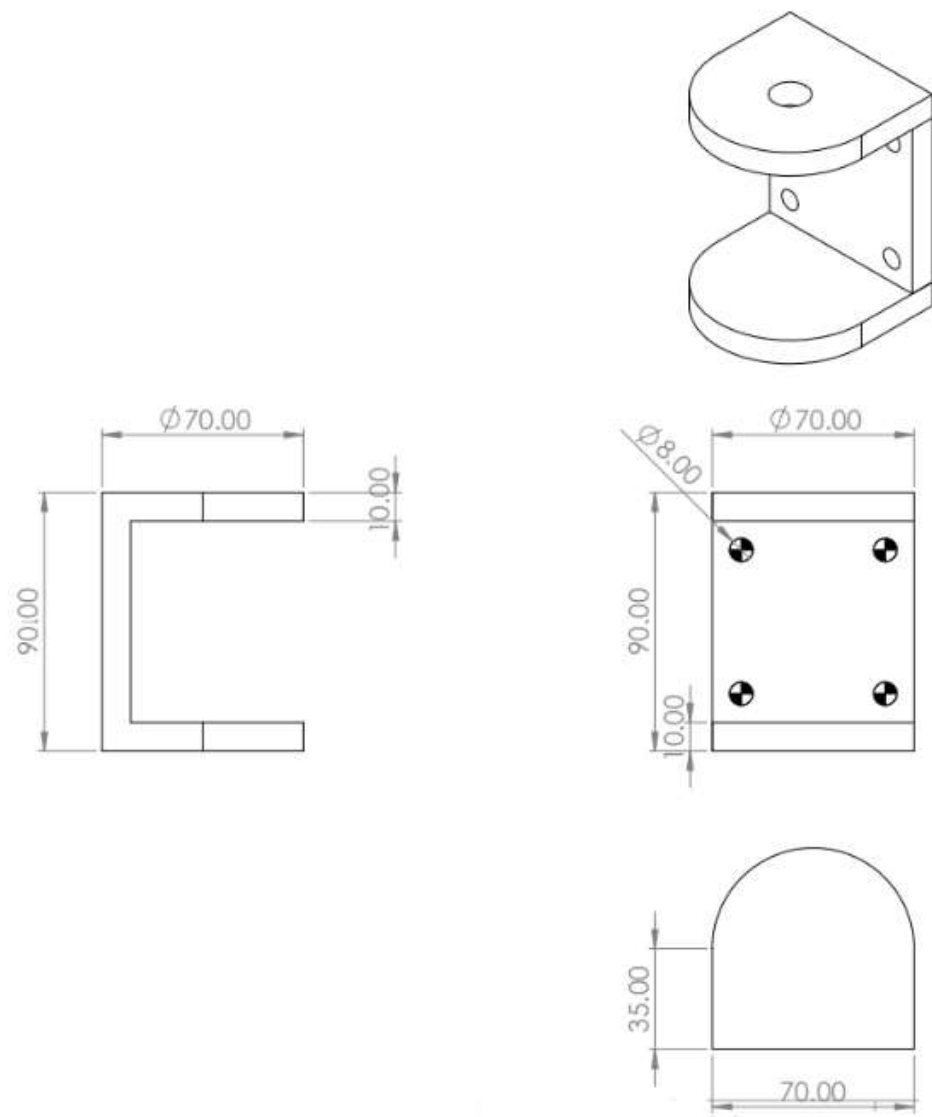
Isometric View:

- Shows the 3D structure of the Main Frame assembly.

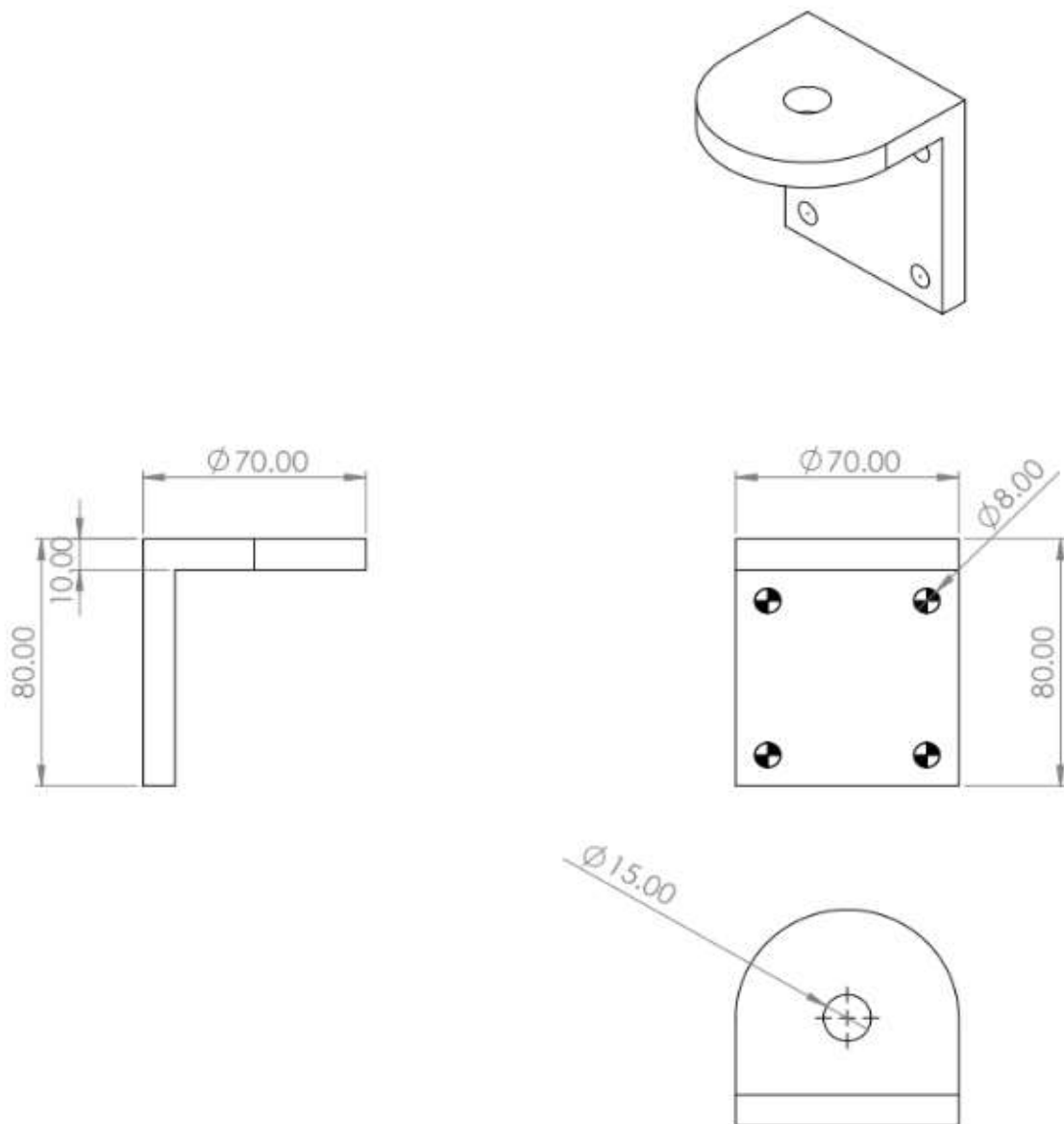
Screw



Bracket



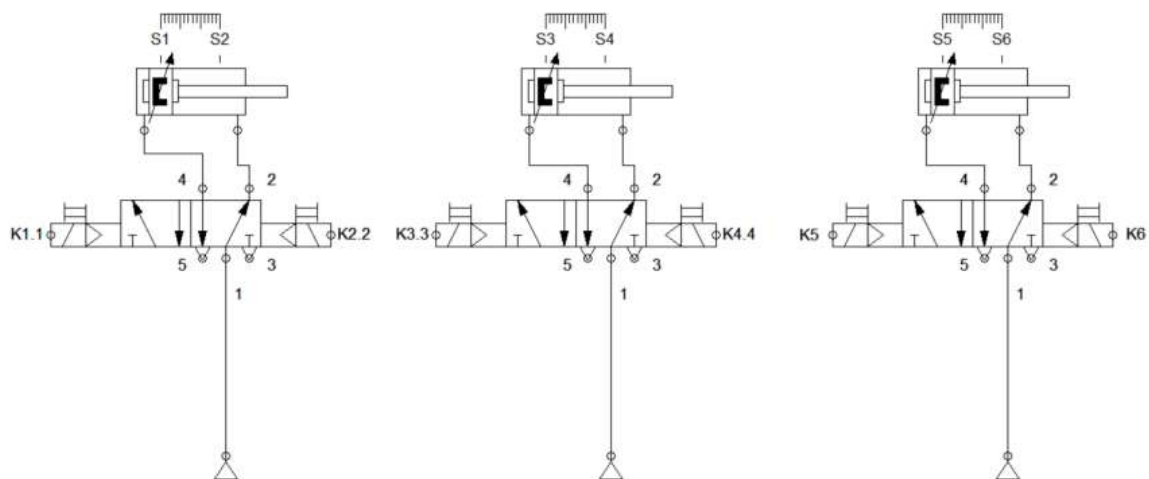
Bracket 2



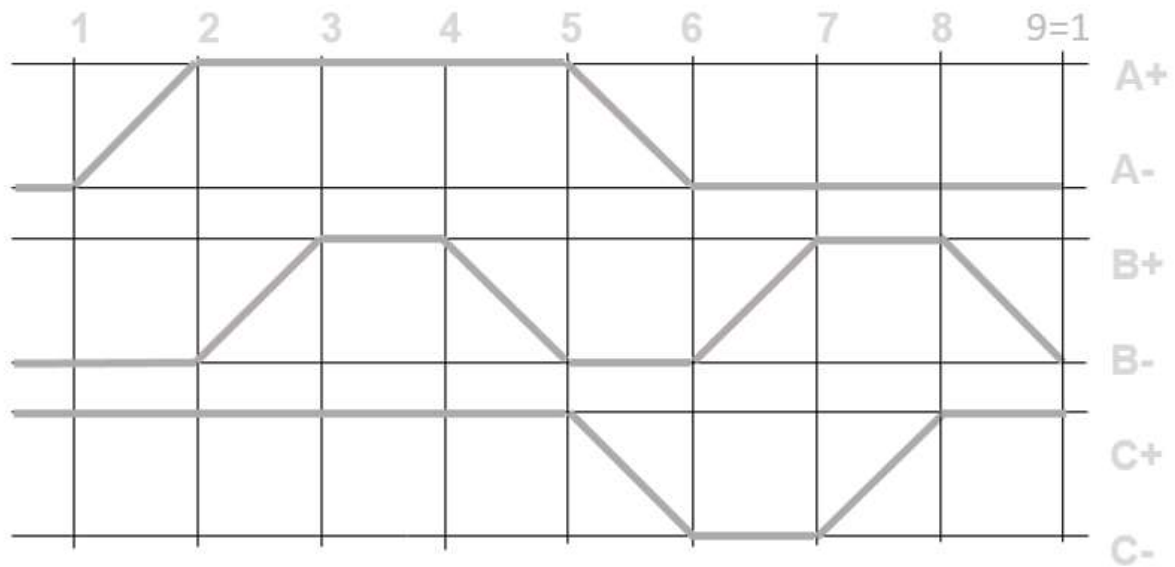
Project Components list and PDF Description

	Name	Description	Quantity	Photo	Datasheet
1	Double acting Pneumatic cylinder	Piston encased cylinder that can move both ways using air pressure at either side	3		<u>Double Acting Cylinder</u>
2	Reed switch	Switches identifying the position of the piston	6		<u>Reed Switch</u>
3	Capacitive sensor	Proximity sensor representing if something is present or close	1		<u>Capacitive Sensor</u>
4	Valves	Control air flow to move pistons in desired direction	3		<u>Valves</u>
5	Electro-magnet	Electronically activated magnet	1		<u>Electromagnet</u>
6	Relay	Electronically controlled switch	7		<u>Relay</u>
7	Bolts	Mounting pneumatic cylinders	3		<u>Bolt</u>
8	Nuts	Securing bolts	3		<u>Nut</u>
9	Screws	Securing brackets	8		<u>Screw</u>

Pneumatic Circuit



Pneumatic Step Diagram and Description



A represents the cylinder for the main frame.

B represents the cylinder for the electromagnet attached to the main frame.

C represents the cylinder for the ejection plate attached to the base.

The sequence starts by a capacitive sensor determining whether there's material on the ejection plate, it then extends the main frame piston to be aligned right above. Afterwards, the electromagnet is descended by piston B to reach the material activating the magnet. Later, the electromagnet is retracted back and the main frame is moved back to align then extend the electromagnet on top of the box to dispose metallic material inside. Lastly, the ejection plate piston is retracted to dispose the non-metallic material then it extends so new material can be placed.

Hardware Model (Electrical + Mechanical)

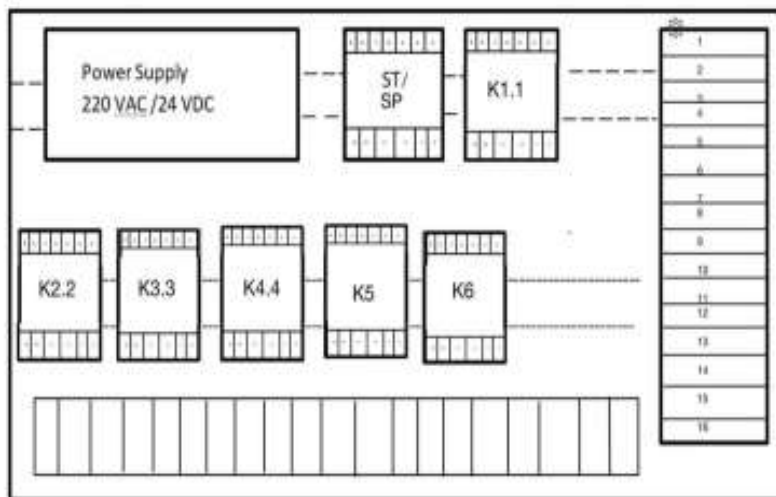
Including

Controller Operating Panel/ Classic Control Implementation

Part A: Electrical

1. List of materials used:

- 24V – 1.5 A Power supply
- 7 relays
- 2 Pushbuttons
- 3 solenoid valves
- Omega
- Wiring Ducts
- Rosetta
- Fuses



Part B: Mechanical:

List of components used:

- Wood
- 2 Metallic brackets and 3 metallic End-effectors.
- Bolts and nuts

Project Hardware As Built

