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Pick and Place Robot Arm

Conceptual Design Report

Discussion Group C
Group 8

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EN2160 - Electronic Design Realization

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Contents

1 Robot Arm Concepts

1.1 Multi Axis Robot Arm

A multi-axial robot arm is an advanced robotic design characterized by its ability to move in multiple directions or axes, offering increased degrees of freedom (DOFs) compared to traditional robotic arms. This enhanced flexibility enables the robot to perform complex and intricate tasks with precision and adaptability.

1.1.1 Multi Axial Robot Arm Concept Design

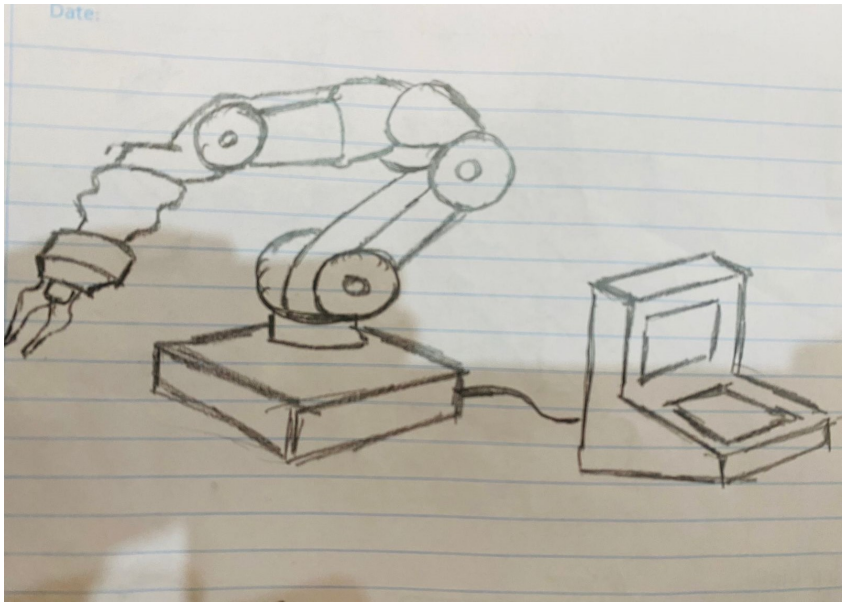

Figure 1: Multi Axial Robot Arm Concept Design

1.1.2 Multi Axial Robot Arm Block Diagram

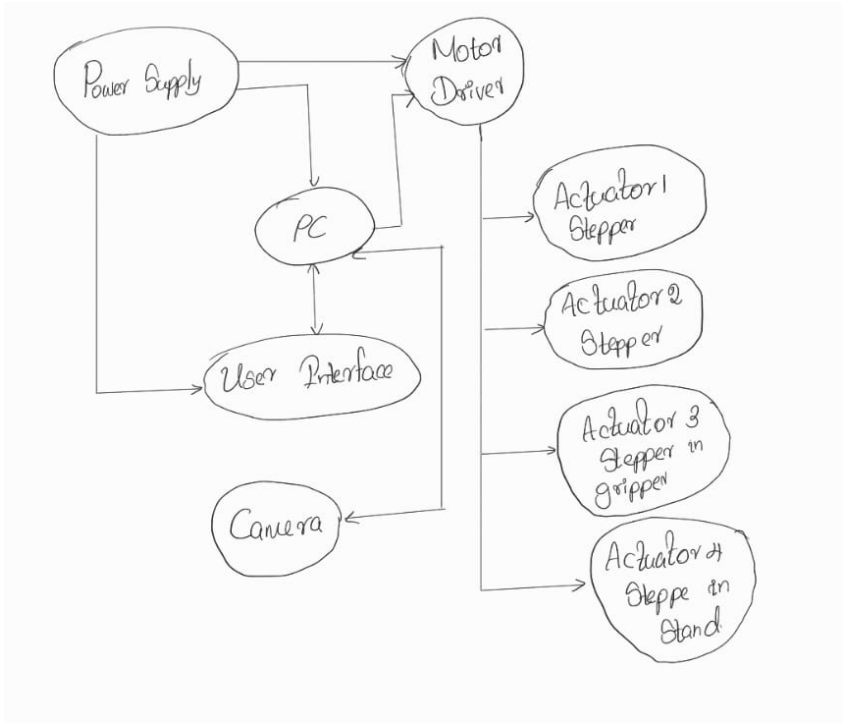

Figure 2: Multi Axial Robot Arm Block Diagram

1.2 Screw-Rod Based Robot Arm

A Screw-Rod Based Robot Arm is a specialized robotic design that utilizes a screw or rod mechanism for its motion, enabling it to move vertically and horizontally with precision. This type of robot arm design is particularly effective in applications where linear motion along specific axes is crucial.

1.2.1 Screw-Rod Based Robot Arm Concept Design

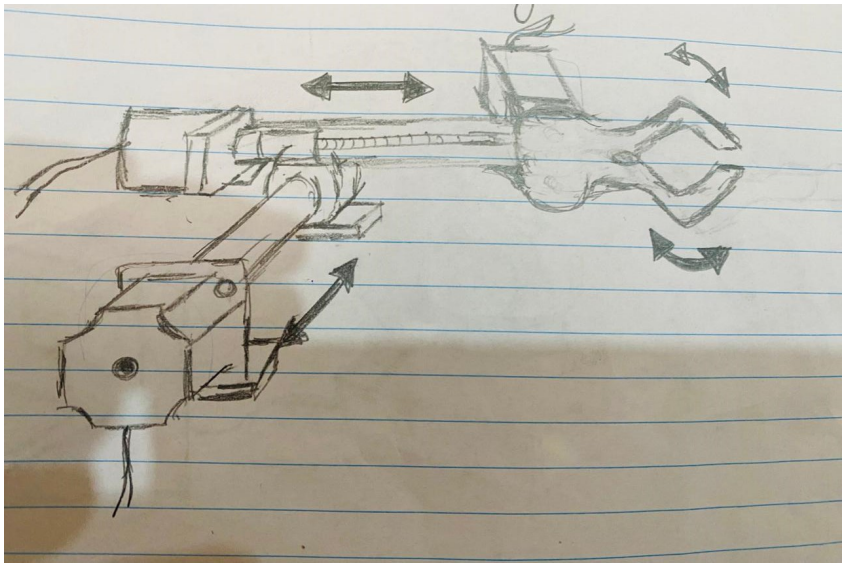

Figure 3: Screw-Rod Based Robot Arm Concept Design

1.2.2 Screw-Rod Based Robot Arm Block Diagram

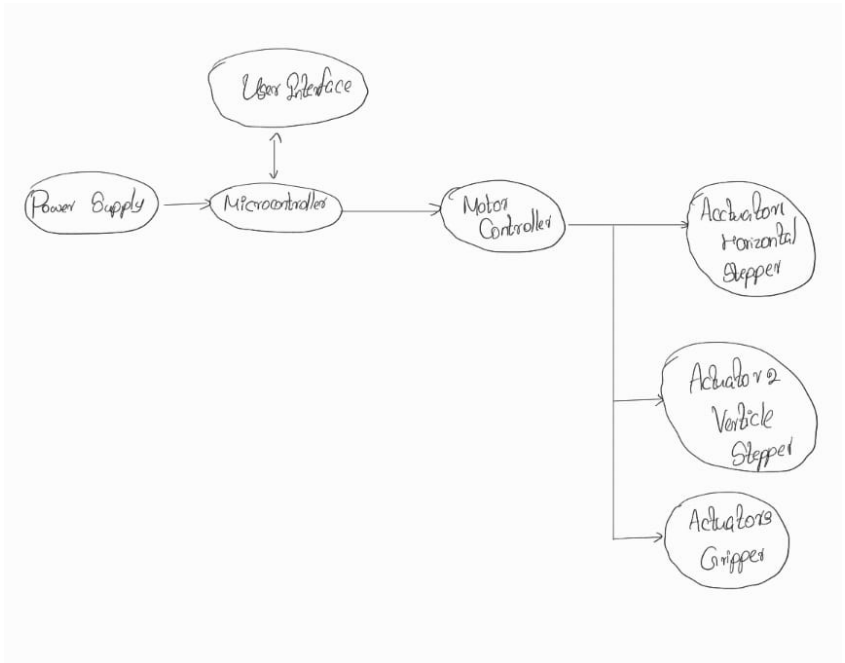

Figure 4: Screw-Rod Based Robot Arm Block Diagram

1.3 Feeder Assembler System

A Feeder Assembler System is a sophisticated automation solution designed to efficiently gather components from multiple conveyors and assemble them at a centralized point. This system is widely used in manufacturing and assembly lines to streamline production processes and enhance overall efficiency.

1.3.1 Feeder Assembler System Concept Diagram

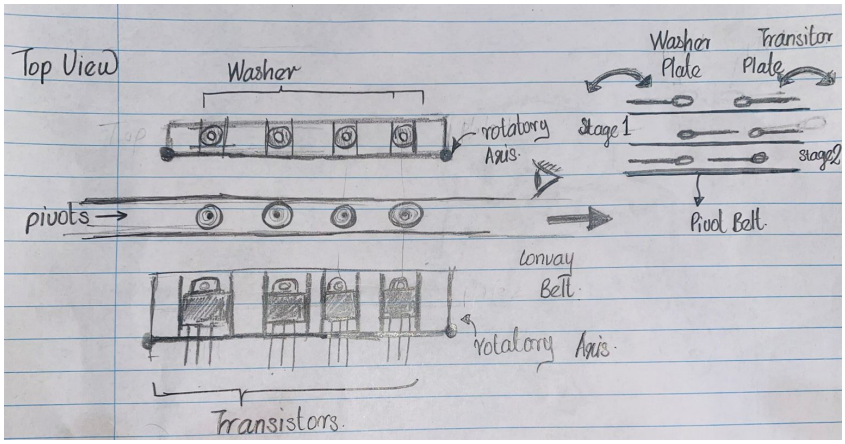

Figure 5: Feeder Assembler System Concept Diagram

1.3.2 Feeder Assembler System Block Diagrams

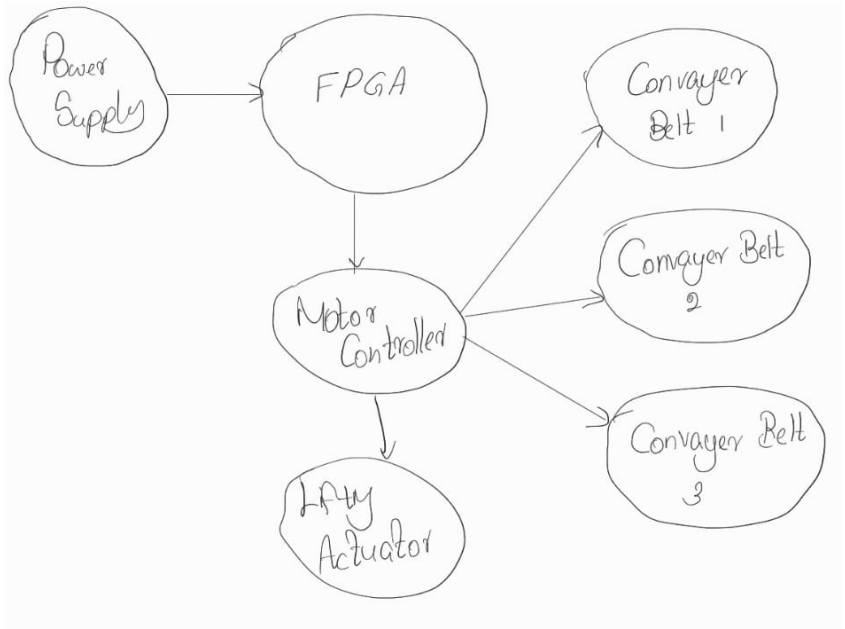

Figure 6: Feeder Assembler System Block Diagram

2 Gripper

2.1 Mechanical Gripper

This is a concept of the gripper that uses stepper motor and mechanical system for gripping

2.1.1 Mechanical Gripper Concept

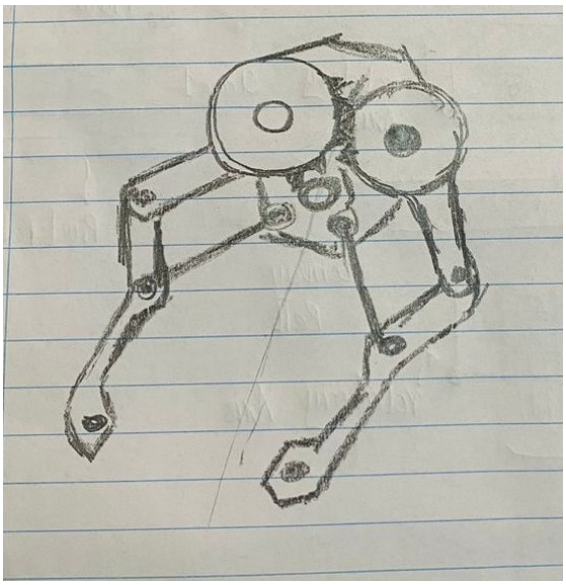

Figure 7: Mechanical Gripper Concept

2.1.2 Mechanical Gripper Block Diagram

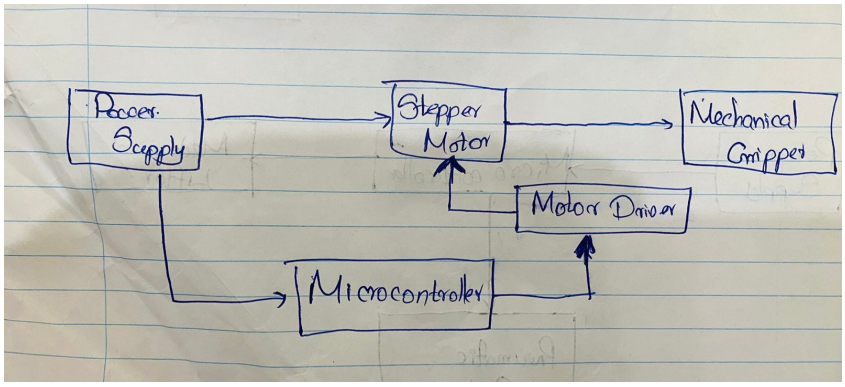

Figure 8: Mechanical Gripper Block Diagram

2.2 Suction Gripper

This is a concept of the gripper that uses pneumatic vacuum concepts to suck the components and grip them.

2.2.1 Suction Gripper Concept Diagram

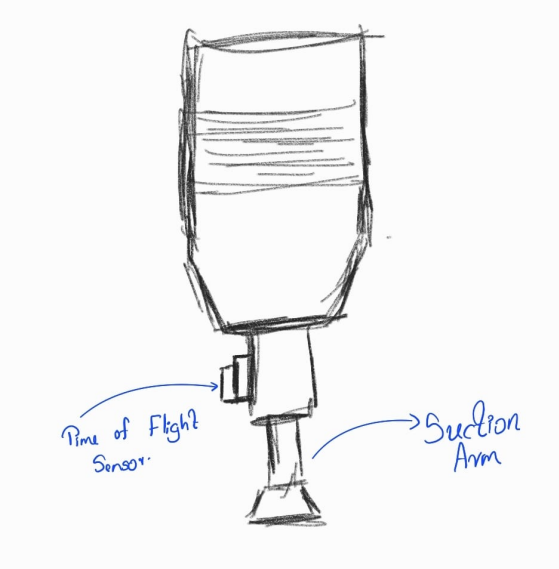

Figure 9: Pneumatic Suction Gripper Concept Diagram

2.2.2 Pneumatic Gripper Block Diagram

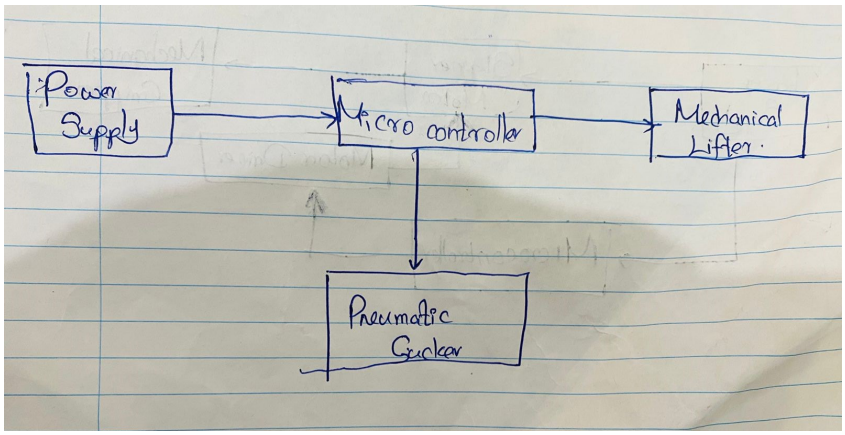

Figure 10: Pneumatic Suction Gripper Block Diagram

3 Design Comparison

Concept Number		Concept 1	Concept 2	Concept 3
Newly added features		Multiple degrees of freedom Increased dexterity Vission Camera	Linear motion vertical and horizontal axes, high positional accuracy, simple mechanical design.	Automated component feeding from multiple conveyors centralized assembly point integration of robotic arm(s)
Envisioned Design		Single axis arm A robotic arm with multiple rotational joints and linkages	A robotic arm using a lead screw or rod mechanisms to achieve linear extension/retraction motions	A system with several feeder conveyors converging to a shared workspace where components are robotically assembled.
Comparison between Mechanical part	Functionality	7	9	7
	Assembly	6	9	7
	Serviceability	5	9	7
	Simplicity	5	9	7
	Durability	8	9	8
	Ergonomics	8	8	8
Comparison between Functional block diagram	Functionality	8	9	7
	User experience	6	9	7
	Feasibility	6	9	6
	Cost(neg.effect)	6	7	5
	Performance	7	8	7
	Power(neg.effect)	6	8	6
Total		78	103	82

Figure 11: Deisgn Concept Comparisopn

4 Enclosure Design Criteria

1. **Functionality**: How well the design supports the main functionalities?
2. **Aesthetics**: How much eye-catching and overall appeal of the user?
3. **Heat Dissipation**: How much heat is generated and how well it has been managed?
4. **Assembly and Serviceability**: How easily does the assembly and disassembly is done?
5. **Ergonomics**: How well does the design fit in the user's hand and allow easy interaction?
6. **Durability**: How well does the design withstand impacts and environmental conditions?
7. **Simplicity**: How simple is the design?

5 Functional Block Diagram Criteria

1. **Functionality**: How well the circuit design meets functional requirements?
2. **User Experience**: How intuitive and user-friendly is the interaction?
3. **Manufacturing Feasibility**: Evaluate the feasibility of manufacturing the design.
4. **Cost**: Evaluate the overall cost-effectiveness for the provided functionality.
5. **Performance**: Evaluate signal quality, resolution, and bandwidth range?
6. **Future Proofing**: To what extent does the design allow for easy replacement or upgrade of individual components?
7. **Power Efficiency**: How effectively does the device manage power consumption?