Manipulator Module Initial Bill of Materials (BOM)

MCT333 Mechatronic System Design

1 Manipulator Initial BOM

1.1 Arm Structure & Mechanics BOM

- Standardized modular base mounting plate (laser cut aluminum or 3D printed PETG/ABS)

- Quick-release latch mechanism and chamfered alignment pins

- Arm linkages (Carbon fiber tubes and/or structurally ribbed 3D printed components)

- Base joint thrust bearing (to support horizontal panning under vertical moment load)

- Gripper chassis and V-shaped interlocking jaws

- High-friction silicone grip pads (for $5 \times 5 \times 5$ cm cubes)

- Offset camera mounting bracket

- Cable routing: Drag chains, spiral wrap, and zip ties

- Fasteners set:

  - M2/M2.5 screws and nuts (for servo horns and camera mounting)
  - M3/M4 screws, nylon lock nuts, and washers (for main structural joints)
  - Medium-strength threadlocker

1.2 Actuation & Electronics BOM

- Smart serial servos ($\times 3$) (e.g., Dynamixel or Feetech, with integrated absolute encoders and PID)

- Micro PWM servo ($\times 1$) (for gripper actuation)

- Aluminum servo horns and heavy-duty structural brackets

- Custom Manipulator PCB (incorporating MCU, buck converters, and CAN/RS-485 transceiver)

- End-effector RGB Camera (USB or MIPI interface for QR code reading)

- Active LED ring light (for consistent QR code illumination)

- High-flexibility silicone wiring (3-wire/4-wire daisy chain cables for smart servos)

- Modular interface connectors (Plug-and-Play interface):

  - Power: XT60 or Anderson Powerpole connector
  - Data: JST-SM or locking Aviation plug