Description

Stepper Motors were used to control the base and arm rotation of the robotic arm because they offer precise control over position and angle. With each step, the motor moves a fixed amount, allowing us to rotate the arm smoothly and accurately using remote input. Two stepper motors were used for multi-axis movement.

The Servo Motor was used to control the gripper mechanism. Servos are ideal for such applications because they can quickly move to a specific angle (e.g., 0° to 90°) and hold that position with torque. This allows the gripper to open and close to grab or release objects, based on the IR proximity sensor input.

The TSOP IR receiver is connected to a TV remote, which acts as the wireless controller. When you press a button on the remote, it sends an IR signal that is decoded by the Arduino using the IRremote library. Based on the received command, the Arduino instructs the stepper motors to move forward or backward by a certain number of steps. This allows you to manually control the rotation and positioning of the robotic arm with simple button presses.

The IR sensor near the gripper doesn't detect objects automatically — instead, we intentionally place a hand (or any object) in front of it to trigger the servo. When the IR sensor detects something (like a hand), the Arduino sends a signal to the servo motor to close the gripper (rotate to 90°). When nothing is in front of the sensor, the servo opens the gripper (rotates back to 0°).

Hardware

The body of the robotic arm was constructed using WPC (Wood Plastic Composite), providing a sturdy yet lightweight frame.
The gripper was custom-built using plastic laminate sheets for the structure. A cotton thread was attached to the servo motor, which acted as a pulley mechanism—pulling the gripper open or closed based on the servo's rotation. This simple yet effective design allowed for reliable gripping action using basic materials.

Circuit diagram
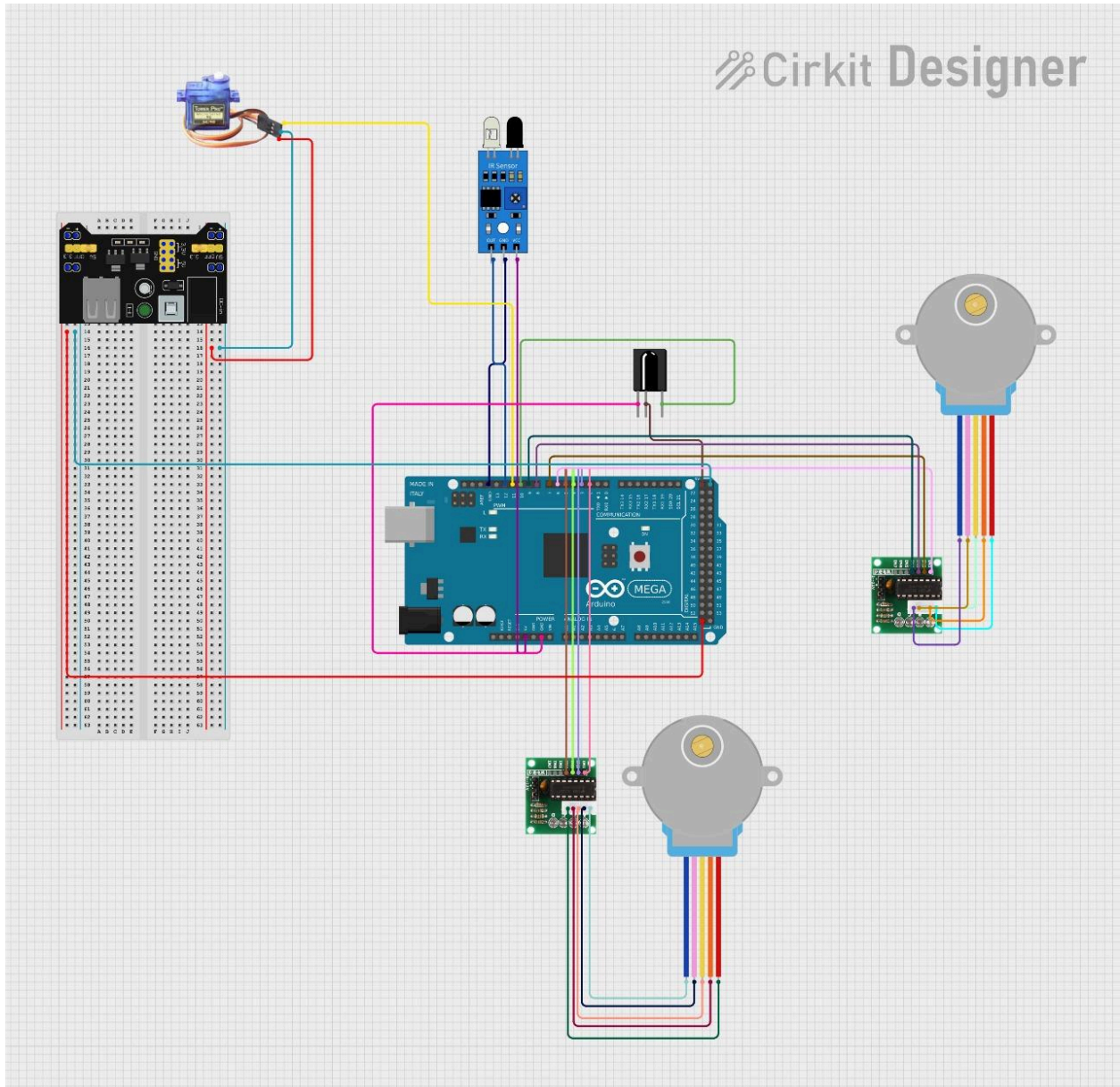
Circuit connections

Stepper Motor 1 (Connected to pins 2, 3, 4, 5)

Assuming you're using a ULN2003 driver board:

- IN1 → Pin 2

- IN2 → Pin 3

- IN3 → Pin 4

- IN4 → Pin 5

- VCC → 5V

- GND → GND

- Motor connector → 28BYJ-48 motor

Stepper Motor 2 (Connected to pins 6, 7, 8, 9)

Second ULN2003 driver:

- IN1 → Pin 6

- IN2 → Pin 7

- IN3 → Pin 8

- IN4 → Pin 9

- VCC → 5V

- GND → GND

- Motor connector → 28BYJ-48 motor

Servo Motor

- Signal → Pin 11

- VCC → 3.3V

- GND → GND

TSOP IR Receiver

- OUT → Pin 10

- VCC → 3.3V

- GND → GND

IR Proximity Sensor

- OUT → Pin 12

- VCC → 3.3V

- GND → GND

Images

MH-B

MCU

SW1
SW2
SW3
SW4

TSOP
LM35
LDR
R6
POT
BUZZER
Relay Module

Silicontechnolabs
Digital & Analog
IO Board
STL030U1.0

C1
R1
R2
D1
D2
Q2
RN1

1 2 3 4 5 6 7 8

GND 5U RELAY BUZZER LDR POT TSOP SW1 SW2 SW3 SW4

Digital & Analog IO Board   www.silicontechnolabs.in