EW 1 : Final Evaluation

OBJECT FOLLOWING ROVER

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Team ID : 44

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01 Motivation

Motivation

As students, we were enthusiastic about taking on the challenge of designing and building this rover.
This project provided an opportunity to deepen our understanding of electronics while gaining hands-on experience with sensors and their integration. Additionally, the process of testing the rover across various scenarios allowed us to explore practical applications and refine our problem-solving skills.

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Problem Statement

Problem Statement

We were tasked with designing and building an Object-Following Rover—a robotic system capable of detecting and tracking an object in its vicinity using sensors, enabling it to autonomously follow the object.

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REQUIREMENTS

Requirements

L293D (Motor Driver):

- **Controls the motors to drive the rover forward, backward, or turn.**

Ultrasonic Sensor:

- **Detects obstacles in front the rover for navigation.**

IR Sensors (Left and Right):

- **Senses objects or boundaries on the left and right to adjust direction.**

Requirements

Arduino:

- **Processes sensor data and controls motors for movement.**

Servo Motor:

- **Adjusts sensor position to track objects and change direction.**

Motors and Wheels:

- **Enable rover movement based on commands from the motor driver.**

OUR ASSUMPTION

This project assumes that the rover will operate in an environment devoid of any obstacles, except for a single object.

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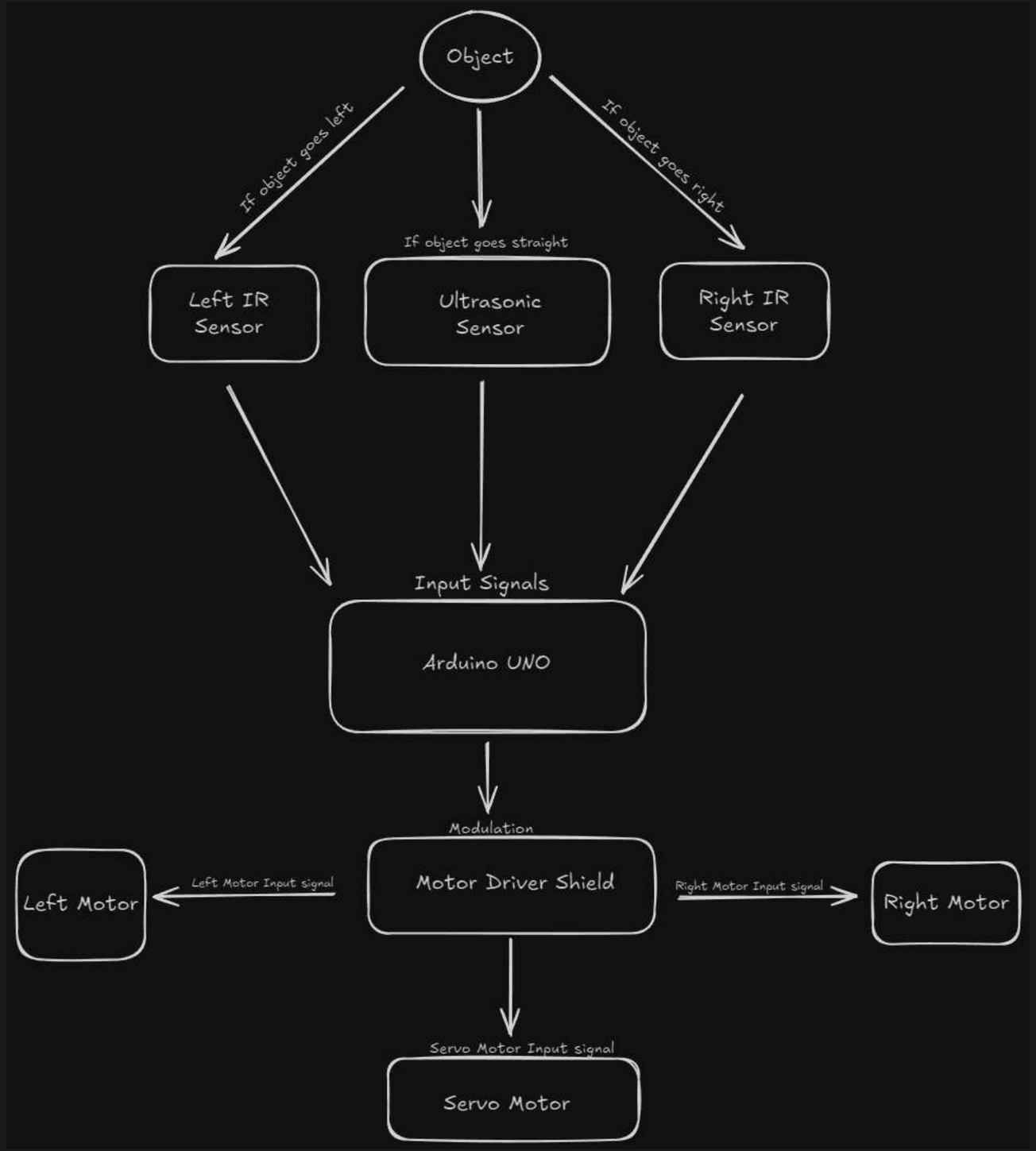
BLOCK DIAGRAM


Object
If object goes left
If object goes straight
If object goes right
Left IR Sensor
Ultrasonic Sensor
Right IR Sensor
Input Signals
Arduino UNO
Modulation
Left Motor
Left Motor Input signal
Motor Driver Shield
Right Motor Input signal
Right Motor
Servo Motor Input signal
Servo Motor

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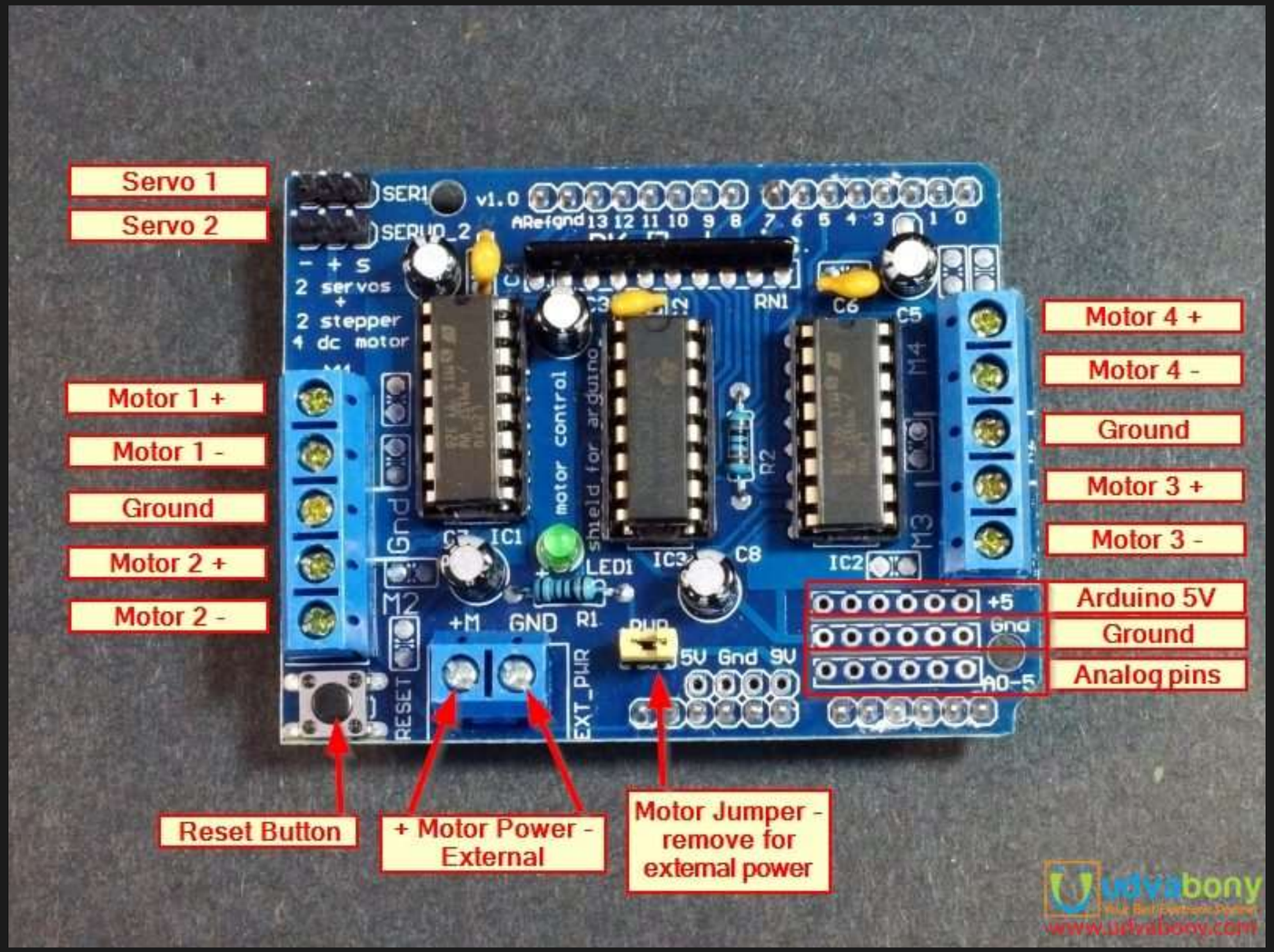
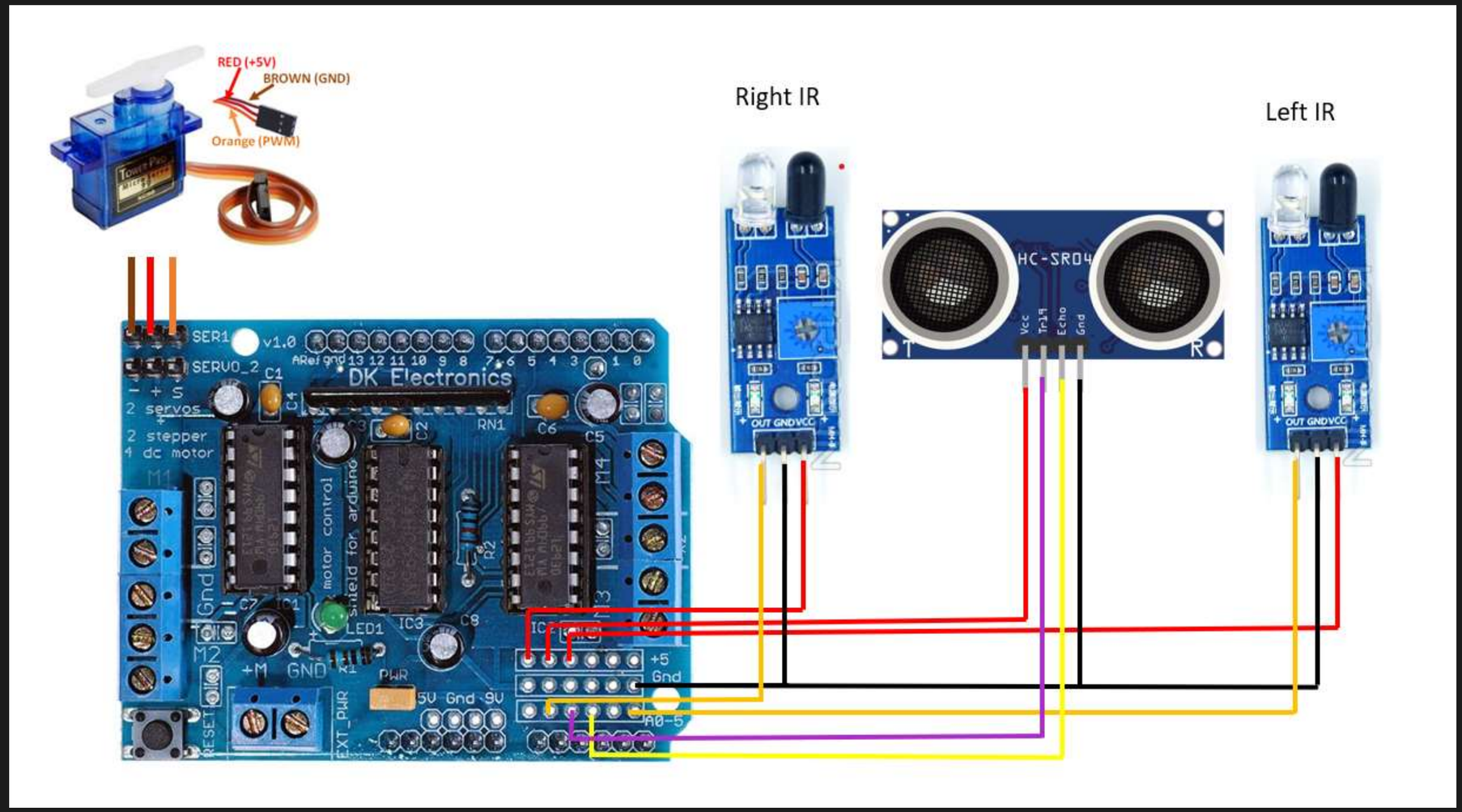
CIRCUIT DIAGRAM

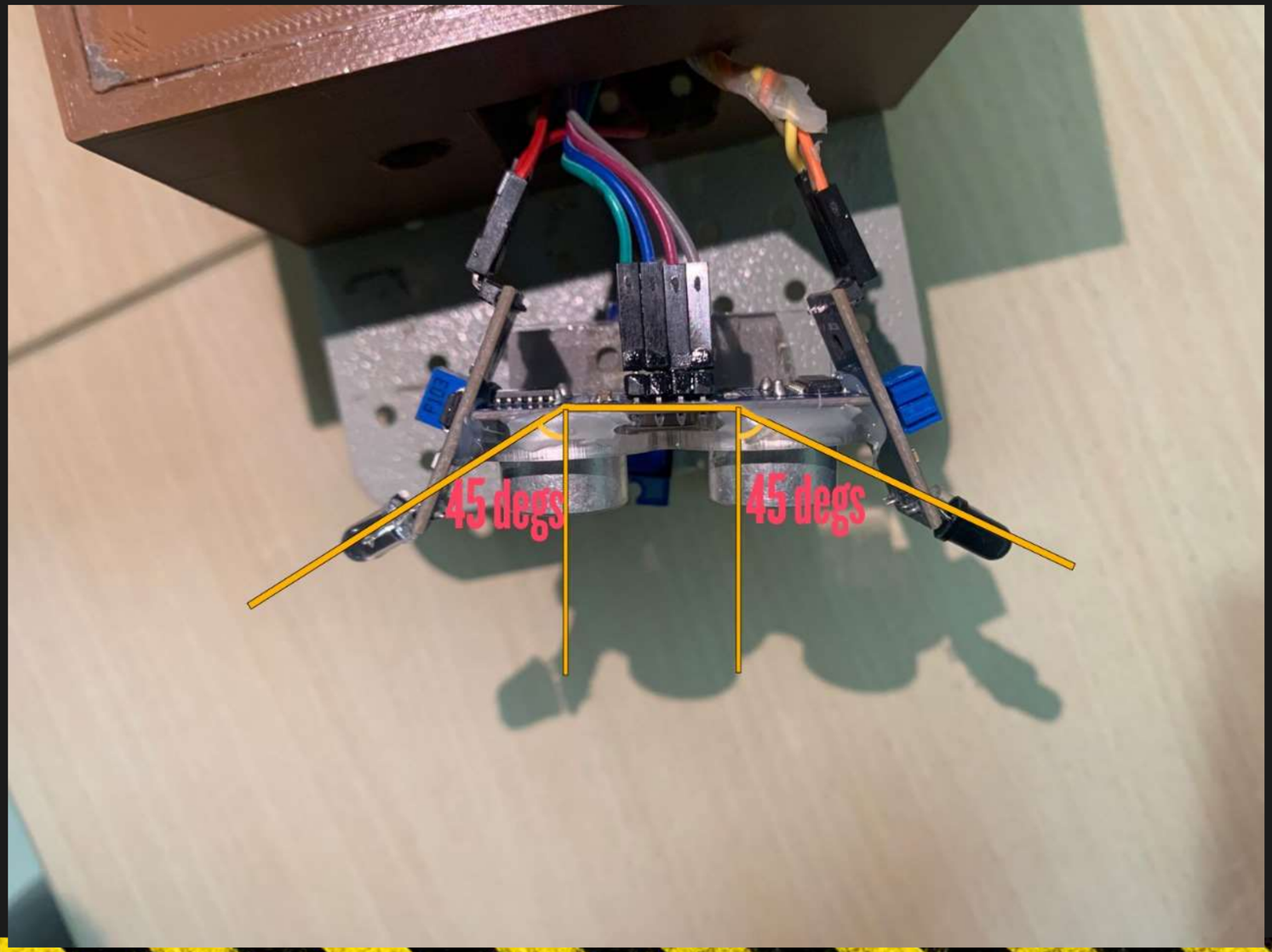
L293D MOTOR DRIVER



CONNECTIONS FROM MOTOR DRIVER TO SENSORS AND SERVO MOTOR

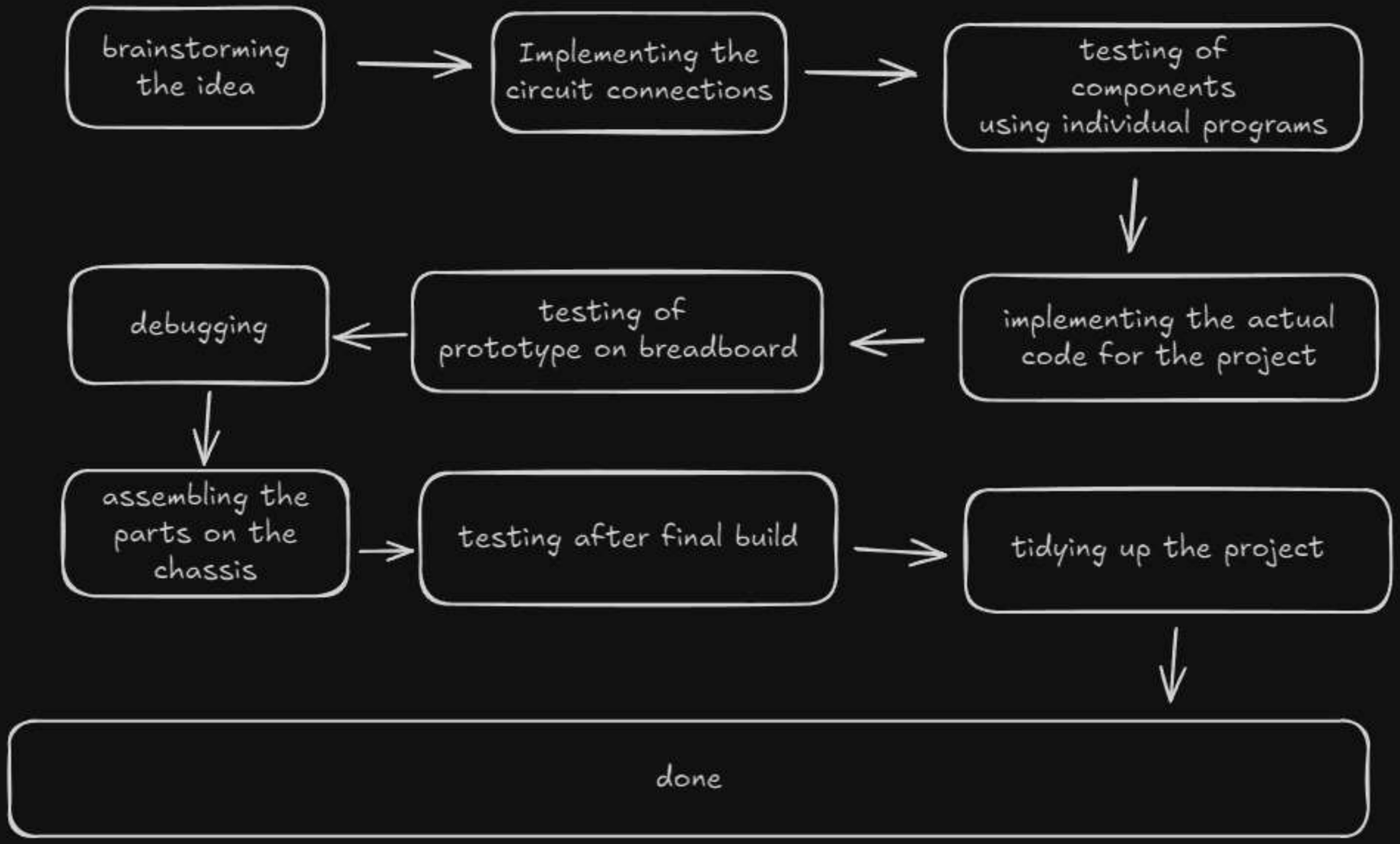


Sensor Placement



PROCESS FLOWCHART

Progress flow



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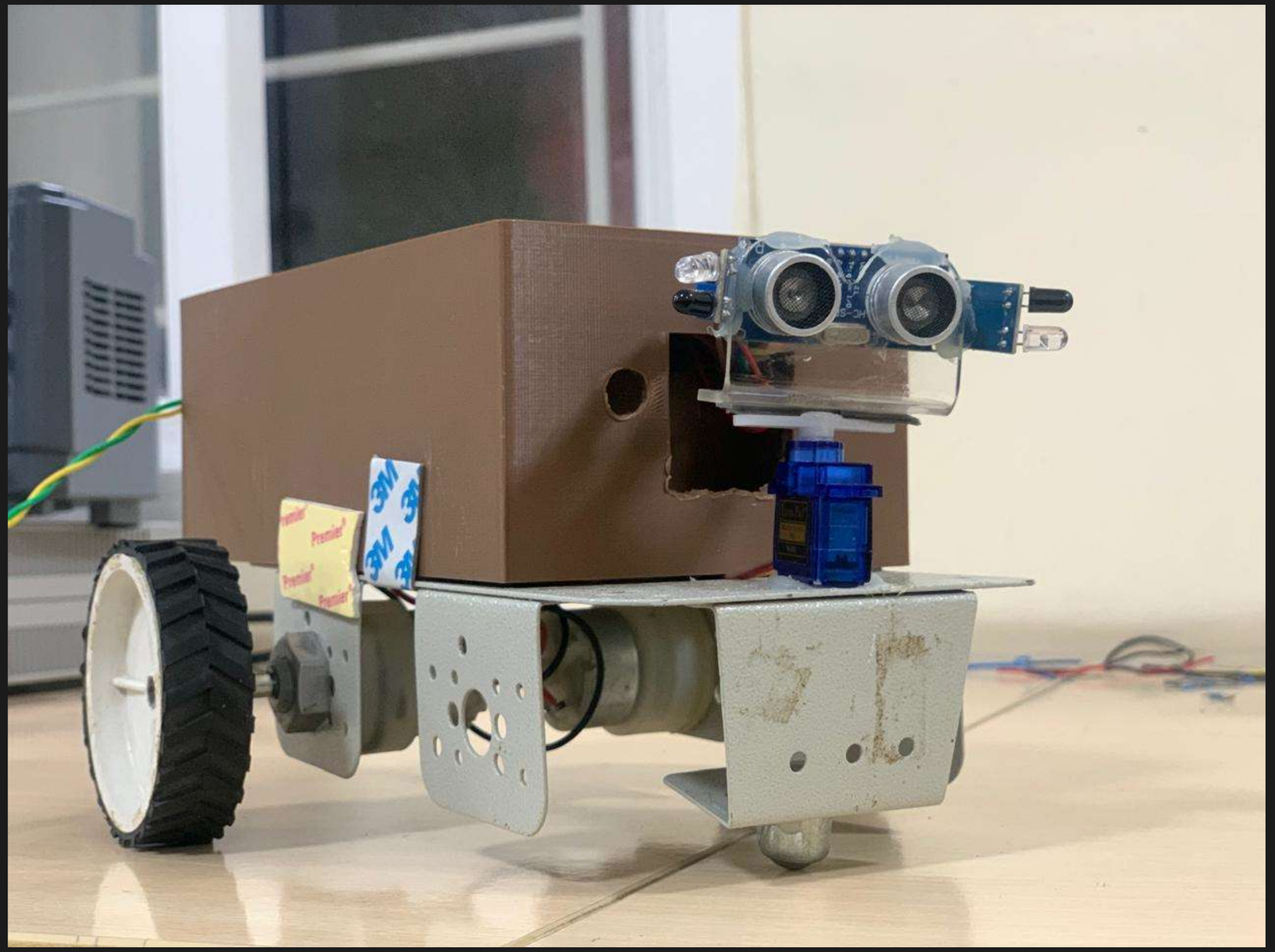
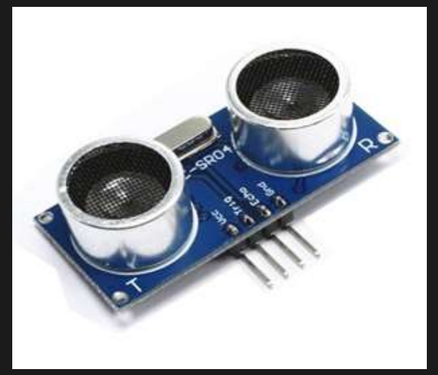
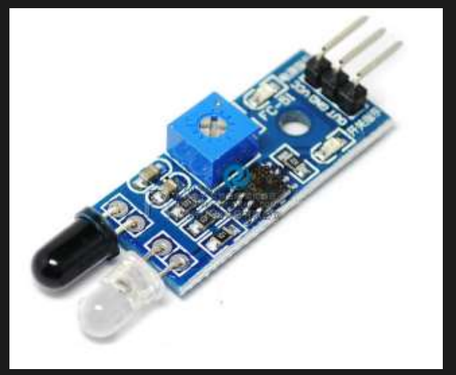
THE DESIGN!

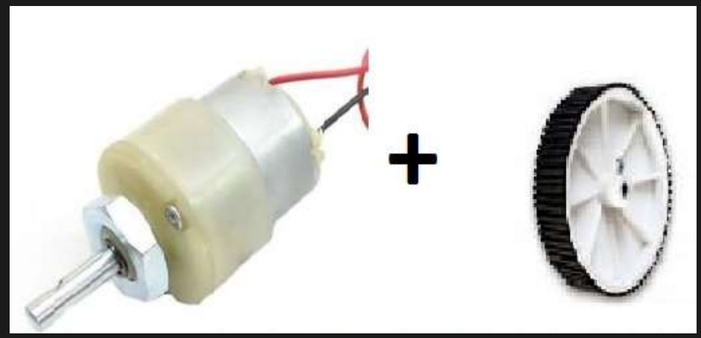


COMPONENTS USED:

1. Arduino UNO
2. L293D Motor Driver
3. Servo motor
4. Ultrasonic sensor
5. IR sensors
6. Jumper wires
7. Motor and Wheels
8. Chassis

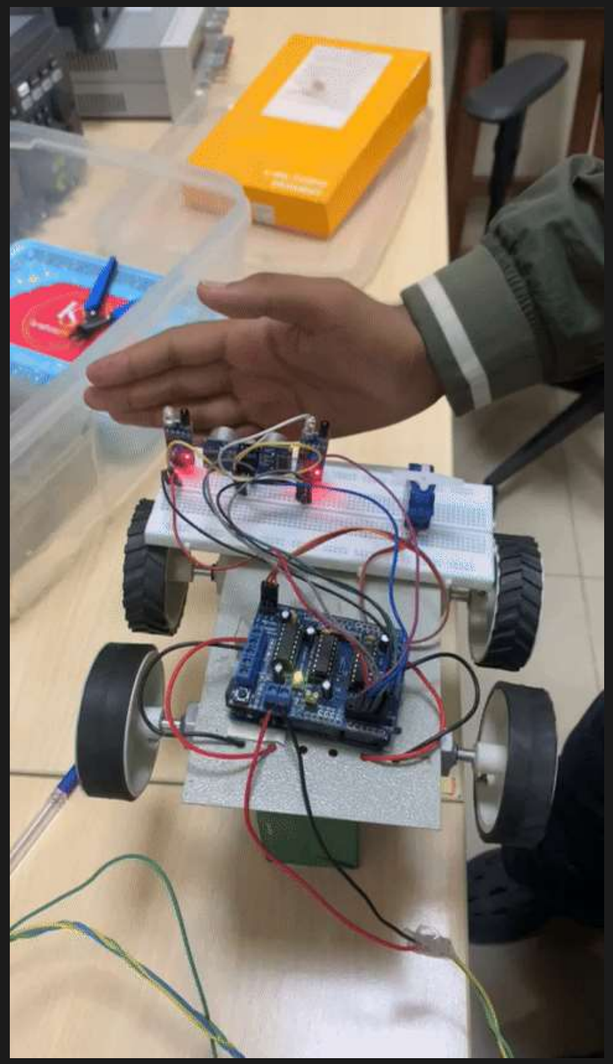






1. The project utilizes ultrasonic and infrared (IR) sensors for autonomous rover navigation.
2. The ultrasonic sensor measures the threshold distance and enables forward movement when an obstacle is detected.
3. IR sensors, positioned on the left and right sides, control the rover's turning direction.
4. A servo motor is integrated to hold the three sensors, allowing the sensor assembly to rotate in alignment with the rover's movement.

PROTOTYPE



DEMO

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IMPROVEMENTS

1. **360-Degree Scanning**: Replace positional servo motor with continuous servo motor
2. **Adaptive Path Planning**: Use algorithms to follow moving objects while avoiding obstacles.
3. **Object Prioritization**: Enable recognition to follow specific objects.

HOW IT COULD BE IMPLEMENTED?

1. 360-Degree Scanning: replace positional servo motor with continuous servo motor
2. Adaptive Path Planning: Implement logic to follow the closest object while avoiding obstacles.
3. Object Prioritization: Use camera modules to enable object recognition.

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COST OF THE SOLUTION

Component	Approximate Cost (INR)	Details
Arduino Uno	₹400 - ₹800	Microcontroller for controlling all components
L293D Motor Driver	₹120 - ₹200	Driver to control the DC motors
Jumper Wires (pack)	₹100 - ₹150	For electrical connections
IR Sensors (2 pcs)	₹200 - ₹300	Detects the direction for turning
Ultrasonic Sensor	₹120 - ₹200	Measures distance from obstacles
Servo Motor	₹250 - ₹400	Rotates the sensor assembly
DC Motors (2 pcs)	₹200 - ₹300	Drives the wheels
Wheels (2 pcs)	₹100 - ₹200	Provides mobility to the rover
Chassis	₹200 - ₹400	The frame holding all components

FINAL ESTIMATE:

ADDITIONAL COST:

Power Supply: Add ₹150 - ₹300 for batteries or a rechargeable power source.

₹2,000 - ₹3,500, depending on component quality and sourcing.

SHORTCOMINGS

Problem: Portability issue
Solution: Battery
Why didn’t we do it: We asked for one but didn’t get it.

Problem: Very low range of defection
Solution: Introduce more ultrasonic sensors to accurately measure the distance as well as compared to only digital signals of IR sensors.
Why didn’t we do it: the chassis was too small, and We would have to 3d print the socket for sensors as the base of it would be big given the size of an ultrasonic sensor.

Problem: motor alignment and speed
Solution: use motors of same rpm
Why didn’t we do it: we asked for four motors of the same rpm but were given two with different rpm and we didn't get another one upon asking

Problem: cable dangling
Solution: make your own chassis design
Why didn’t we do it: we wanted to design the model we wanted to use for the project but was denied 3d printer access

CONTRIBUTION FROM THE TEAM MEMBERS

Siddharth Sinha:

1. Developed and implemented the Arduino code.
2. Managed servo motor control and integration.
3. Connected and tested sensors with the hardware.

Swati Yelamanchili:

1. Worked on the physical appearance of the rover.
2. Connected and tested sensors with the hardware.
3. Conducted final testing and prepared project documentation.

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REMARKS

This electronics workshop enhanced our skills in Arduino programming, sensor integration, and circuit design. As a team of two, we developed an object-following rover using IR and ultrasonic sensors, a motor driver, and a servo motor. The project fostered teamwork, problem-solving, and practical application of theoretical knowledge.

LEARNINGS

1. **Centralized Control**: The Arduino processes sensor inputs and controls the motor driver, enabling coordinated decision-making.
2. **Sensor Priority**: IR sensors take precedence, ensuring immediate response to nearby boundaries or objects.
3. **Motor Driver Role**: The L293D translates Arduino commands into actionable motor control for forward and turning movements.
4. **Adaptability**: The system adjusts direction based on sensor data, prioritizing object tracking.

REFERENCES

1. AFMOTOR library

https://github.com/adafruit/Adafruit-Motor-Shield-library

2. L293D Motor Driver Shield

https://microcontrollerslab.com/arduino-l293d-motor-driver-shield-tutorial/

3. Servo Motor

https://github.com/arduino-libraries/Servo

4. Newping library

https://docs.arduino.cc/libraries/newping/

Thank You!