NATIONAL INSTITUTE OF TECHNOLOGY AGARTALA

Team Name: AutoBots
Project Title: AutoSafe: Intelligent Accident Prevention System
Presented to: Prof. Priyanath Das

TEAM

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INTRODUCTION

Our project aims to design and develop an Arduino-based Automatic Braking System that enhances vehicle safety by detecting obstacles in real-time and responding accordingly. The system is built using an Arduino microcontroller, ultrasonic sensor, and DC motors to simulate a miniature vehicle . The core functionality of our system revolves around distance-based speed control. The ultrasonic sensor continuously measures the distance between the car and any object in front of it.

Based on this distance, the system decides the vehicle's response:

- If the obstacle is more than 5 meters away, the vehicle moves at normal speed.
- If the obstacle is between 2 and 5 meters, the vehicle reduces its speed to avoid potential collision.
- If the obstacle is less than or equal to 2 meters, the vehicle comes to a complete stop to prevent an accident.

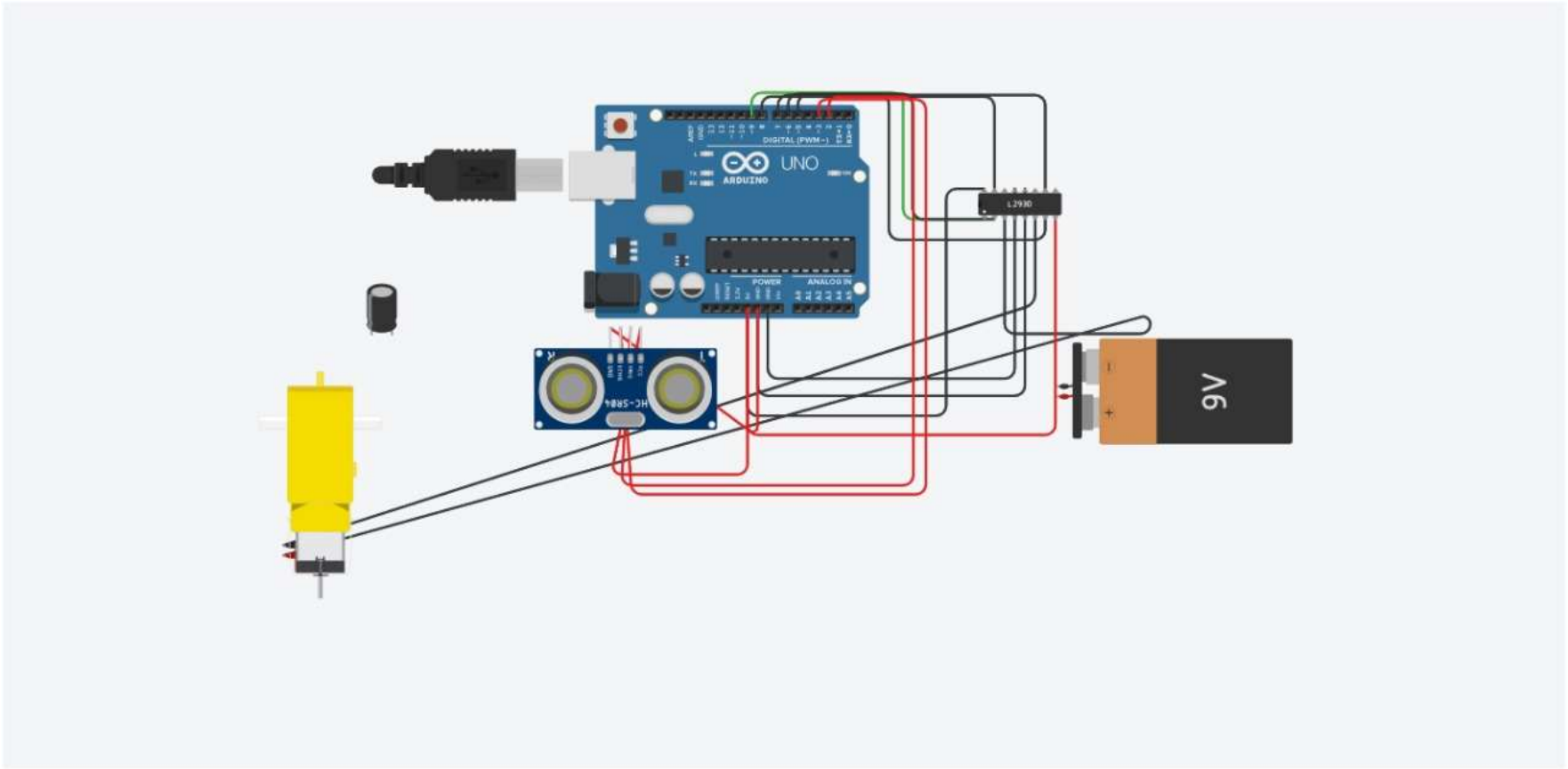
This project demonstrates how embedded systems and sensors can be integrated to mimic intelligent braking systems used in modern vehicles, making driving safer and more responsive. Our prototype will serve as a proof-of-concept for automatic braking in low-cost embedded platforms, suitable for educational and research purposes.

IMPORTANCE AND NEED

Problem Statement	Need
• **Aim:** Prevent collisions by implementing a distance-based automatic braking system. • Increasing number of road accidents due to human error. • Need for a system that can automatically detect and respond to nearby obstacles.	• **Improve Road Safety –** Automated braking reduces the risk of accidents. • **Low Cost Implementation –** Affordable solutions using Arduino and basic sensors. • **Modern Feature Simulation –** Mimics intelligent braking used in smart vehicles.

METHODOLOGY

CIRCUIT DIAGRAM



METHODOLOGY

COMPONENTS USED

- Arduino UNO
- Ultrasonic sensor (HC-SR04)
- DC Gear Motors (x4)
- Generic L293D Motor Driver
- Chassis
- Battery
- Wires
- Wheels (x4)

METHODOLOGY

COMPONENTS INFORMATION

Arduino UNO:

❑ **What is Arduino UNO?**

Arduino UNO is an open-source microcontroller board based on the ATmega328P chip. It is widely used for building electronics projects and prototypes due to its simplicity and versatility.

❑ **Key Features:**

- 14 digital I/O pins (6 can be used as PWM outputs)
- 6 analog input pins
- Clock speed: 16 MHz
- USB interface for easy programming
- Operates at 5V with a DC power jack or USB

❑ **Role in Our Project:**

- Receives input from the ultrasonic sensor (distance detection)
- Processes logic to determine vehicle speed or stopping action
- Sends control signals to the motor driver to adjust wheel speed or stop movement

METHODOLOGY

COMPONENTS INFORMATION

Motor Driver Shield:

- **What is a Motor Driver Shield?**

  A motor driver shield is an add-on board that allows the Arduino to control the speed and direction of DC motors. It acts as an interface between low-power control signals from the Arduino and higher-power motors.

- **We Are Using:**

  Motor Driver Shield based on L293D

METHODOLOGY

COMPONENTS INFORMATION

Ultrasonic sensor:

- **What is an Ultrasonic Sensor?**

  An ultrasonic sensor is a device that uses high-frequency sound waves (ultrasound) to measure the distance between the sensor and an object. In our project, it allows the vehicle to “see” and detect obstacles in its path.

- **We Are Using:**

  HC-SR04 Ultrasonic Distance Sensor.

METHODOLOGY

COMPONENTS INFORMATION

DC Gear Motor:

- **What is a DC Gear Motor?**

  A DC gear motor is a combination of a regular DC motor and a gear reduction system. The gears reduce the motor's speed and increase its torque (rotational force), making it ideal for applications where controlled movement and higher power are needed—like driving wheels in a small vehicle.

- **We Are Using:**

  A typical 6V or 12V DC geared motor (used in DIY robotic cars and Arduino projects).

METHODOLOGY

IDEA

METHODOLOGY

TECHNICAL APPROACH

- **Microcontroller:** Arduino UNO is used as the central controller to process sensor data and motor actions.

- **Obstacle Detection:** An ultrasonic sensor(HC-SR04) continuously measures the distance between the car and any obstacles in front of it.

- **Motor Controller Circuit:** DC motors drive the wheels of the car. Motor's speed is controlled using a motor driver module(L293D) which is then connected to the microcontroller.

METHODOLOGY

TECHNICAL APPROACH (LOGIC)

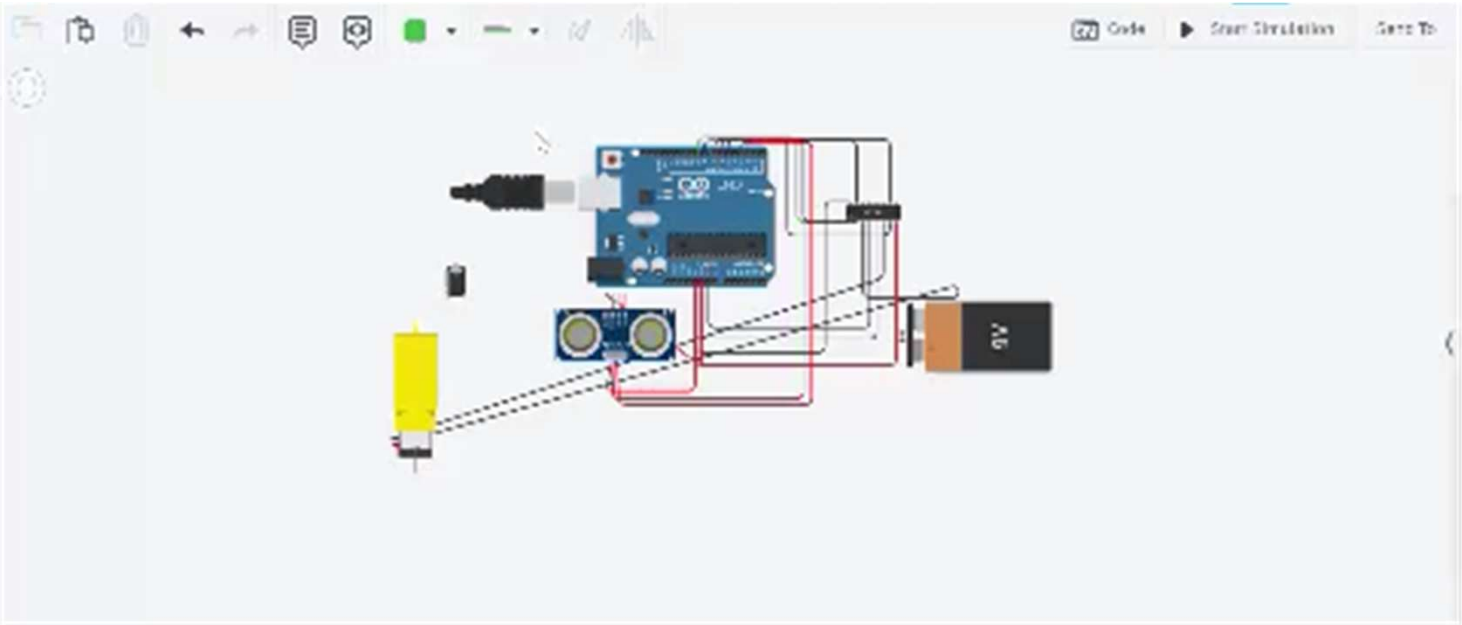
Logic Implementation:

```
if distance > 5 meters:
        Move at normal speed
if 2 meters < distance < 5 meters:
        Move at reduced speed
if distance < = 2 meter:
        STOP
```

Real time Monitoring:
The system constantly updates distance readings and adjusts motor speed in real time based on logic.

IMPLEMENTATION

PROTOTYPE DEMO



IMPLEMENTATION

CONNECTION

Sl.No	Arduino UNO	Motor Driver Shield
1.	D pin 9	Enable 1 and 2 (pin 1)
2.	D pin 6	Input 1 (pin 2)
3.		Output 1 (pin 3)
4.	Gnd	Gnd (pin 4)
5.	Gnd	Gnd (pin 5)
6.		Output 2 (pin 6)
7.	D pin 5	Input 2 (pin 7)
8.	5v	Power 2 (pin 8)
9.	Pin 7	Input 3 (pin 10)
10.	Pin 8	Input 4 (pin 15)
11.	5v	Power 1 (pin 16)

** Pin 9 , 11 , 12 , 13 , 14 of the motor driver shield/L293D IC is not mentioned in the above table as we do not require these pins which are used to control multiple gear motors and we are using only one.

IMPLEMENTATION

CONNECTION

Sl.No	Arduino UNO	Ultrasonic Distance Sensor
1.	5v	Vcc
2.	Pin 2	Trigger
3.	D pin 3	Echo
4.	Gnd	Gnd

Sl.No	Motor Driver Shield	Gear Motor
1.	Output 1 (pin 3)	Any terminal
2.	Output 2 (pin 6)	Any terminal

FUTURE ENHANCEMENT

LONG TERM GOALS

- **Full Collision Avoidance System:** Evolve the prototype into a complete smart vehicle safety system with steering and braking control.
- **Real Vehicle Integration:** Scale the system for real car prototypes or e-rickshaws for actual road testing.
- **Commercial Use:** Offer the model as a low-cost solution for schools, colleges, or budget vehicles lacking advanced driver-assist systems (ADAS).
- **Educational Tool:** Use the system as a training kit for engineering students learning embedded systems and autonomous vehicles.
- **Green Transportation Tie-In:** Combine this with electric vehicle projects to promote safe and sustainable transport solutions.

CONCLUSION

- In this project, we successfully designed and implemented an **Arduino-based Automatic Braking System** that can detect obstacles and respond in real time.
- Using an **ultrasonic sensor**, **DC gear motors**, and a **motor driver**, our prototype simulates a smart vehicle that adjusts its speed or stops based on the distance from obstacles.
- The system demonstrates how basic electronics and programming can be used to build an effective, low-cost safety mechanism for vehicles.
- Our results show consistent and reliable braking behavior, validating the effectiveness of the logic and hardware integration.
- This project not only enhances our technical knowledge but also addresses a real-world issue—**reducing road accidents through automation**.
- With further development and support, this concept can be expanded into a full-fledged **collision avoidance system** suitable for real-life applications.

THANK YOU!!