Object Detection Car

Controlled by

Android Application

A Group Project by –

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Introduction

The **Object Detection Car Controlled by Android Application** is a smart, Wi-Fi Enabled Vehicle can be assumed as a type of remote-controlled car that uses Wi-Fi technology,
and sensors to prevent collision the object's in its path.

Designed for collision prevention and reliable navigation.

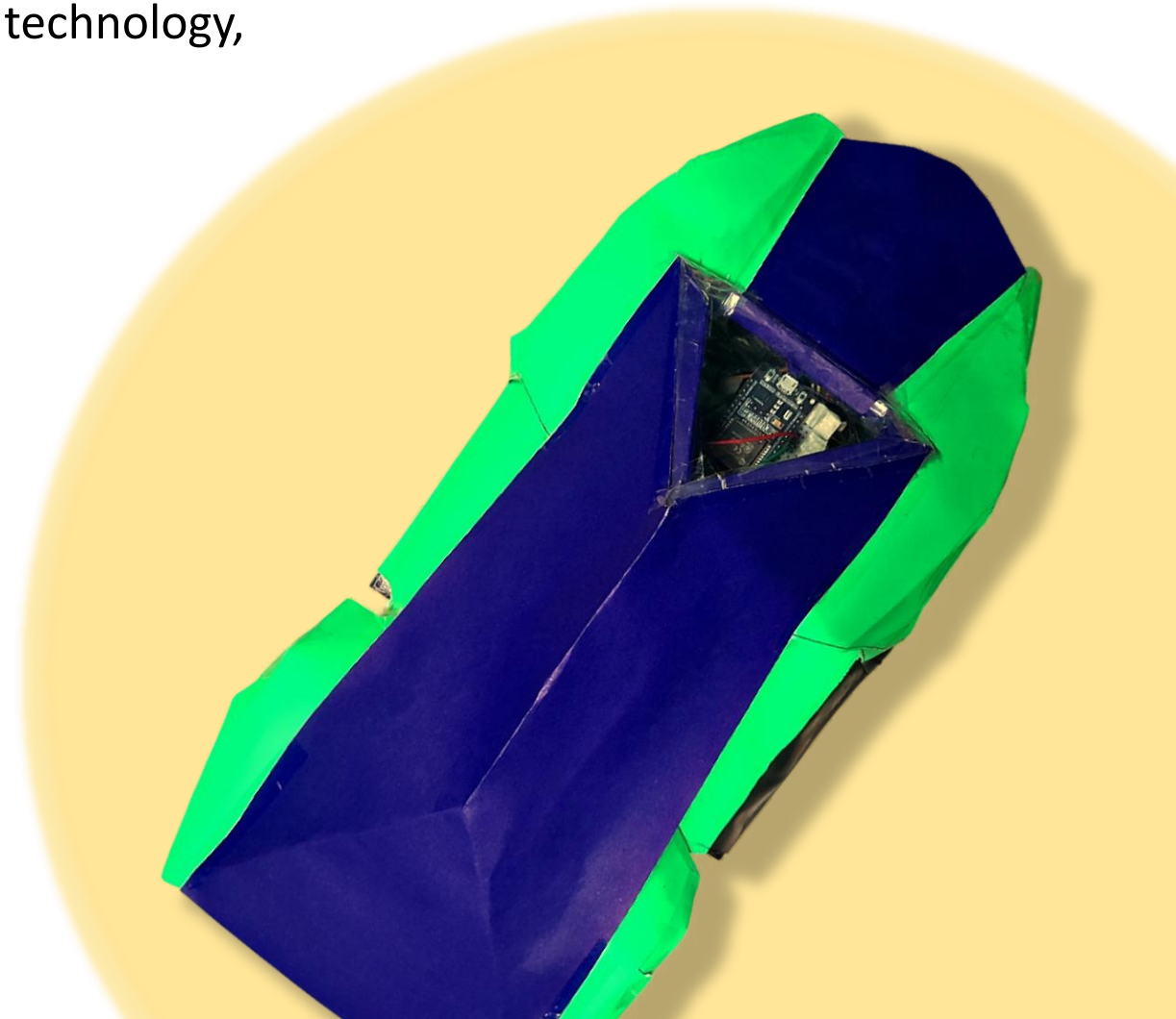
It allows users to control the car using a smartphone.

Equipped with a **ESP32 MCU**, that connects to **network**.

Measures distance data from Sensor's, to detect obstacle in its path.

The car takes immediate corrective actions, to **prevent accidents**, ensuring, a safer driving experience.

- Sends **Response** back to the Application



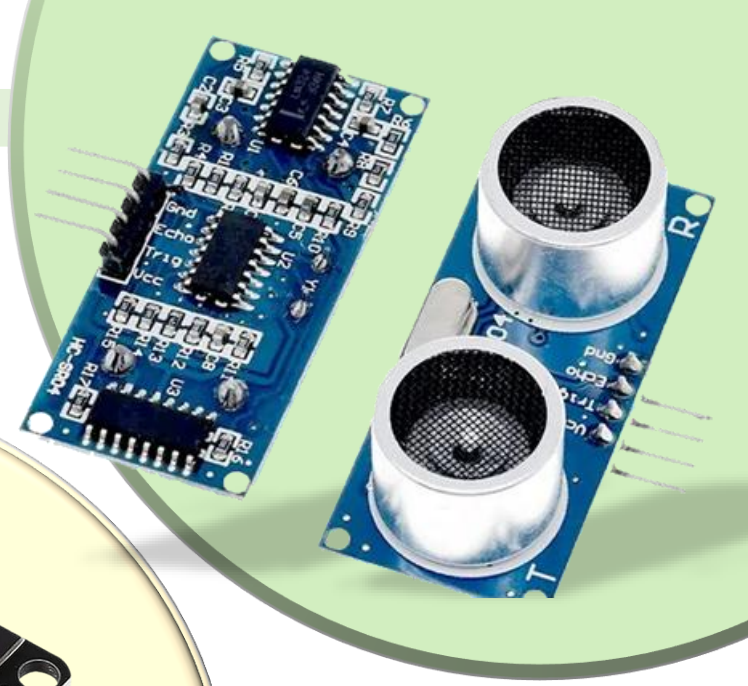
Earlier
Problems

- **Lack** of obstacle detection causes accidents in robotic autonomous system.
- Not using enough distance monitoring in Vehicles for **avoidance accidents.**
- Human-Controlled Systems may fall due to **poor visibility**.
- Autonomous Systems need to be improved.

And the **Solution ?**

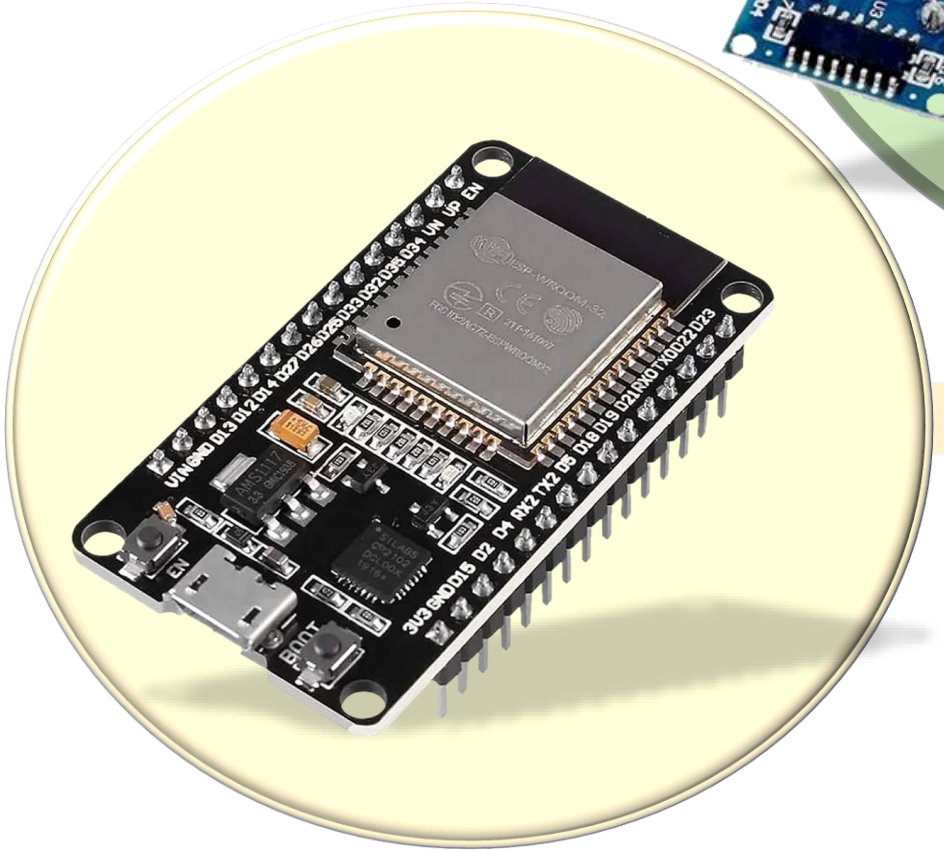
Solution is HERE!

HC-SR04 Ultrasonic Sensors



With

- Reliable obstacle avoidance using Ultrasonic Sensors.
- Remote operating using a Smartphone.



ESP32 Dev Module V1

- The car detects obstacles using an **HC-SR04 ultrasonic sensor**.
- **ESP32 microcontroller** processes the data.
- An Android app sends movement commands over Wi-Fi using **HTTP requests**.
- L293D motor driver controls the car's movements.
- When an obstacle is detected, the car moves **backward and stops**.
- Emphasize how it ensures **safety** and **collision prevention**.
- Sends **Response** to the Application.

But, is it Really Possible?

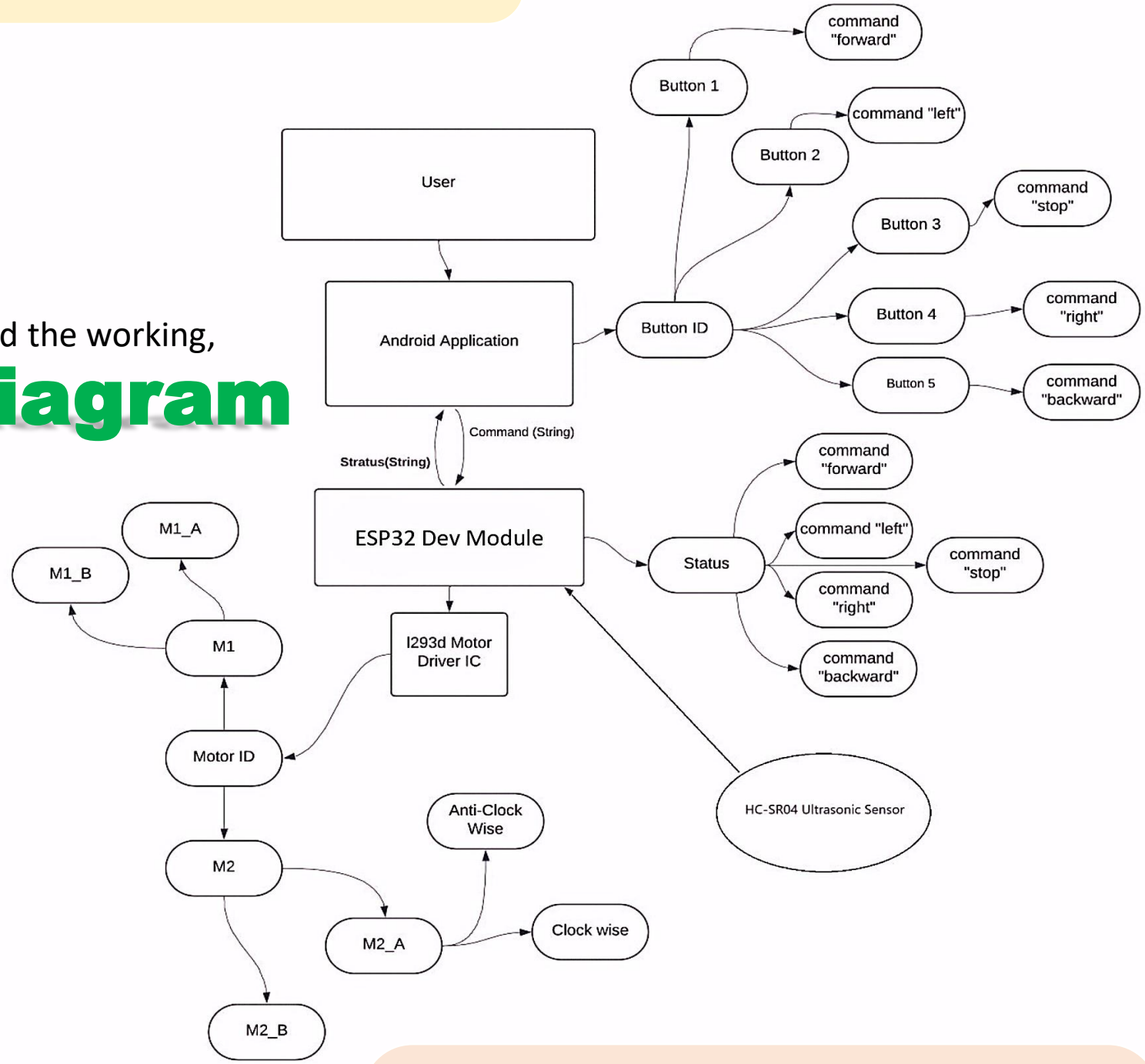
YES

To Easily Understand the **methodology** behind the working,

Take a snap onto the Block Diagram

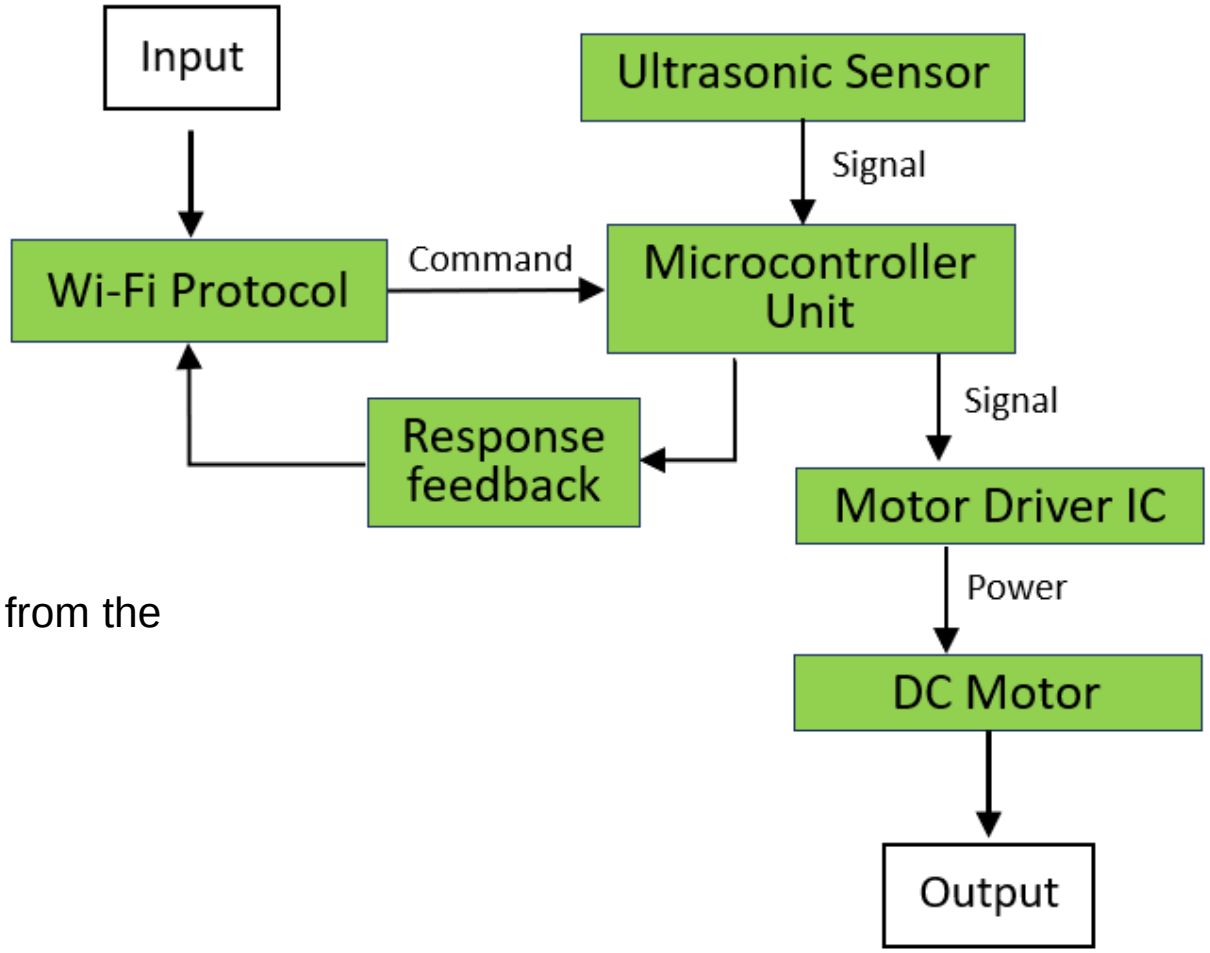
- ESP32 Creates Access Point.
- Android App Checks the Available Connections.
- Android App Sends Commands.
- ESP32 Receives, Processes Requests & sends Responce.
- Device Executes Action.

The **HC-SR04 Ultrasonic Sensor** measures the **distance of nearest object** every second from the **Environment** and sends the Distance value to the **ESP32 Microcontroller.**



NOT that complicated

To understand **more Easily,**



Here, The “Input” is **Commands/Instructions** from the user,

And the “Output” is the **Wheels.**

But, How does the

Communication is Happening ?

Is any kind of Wire, helping the commands to **flow.**

The ESP32 microcontroller utilizes the Wi-Fi protocol to establish a wireless connection,

enabling communication with a smartphone application by using -

HTTP protocol

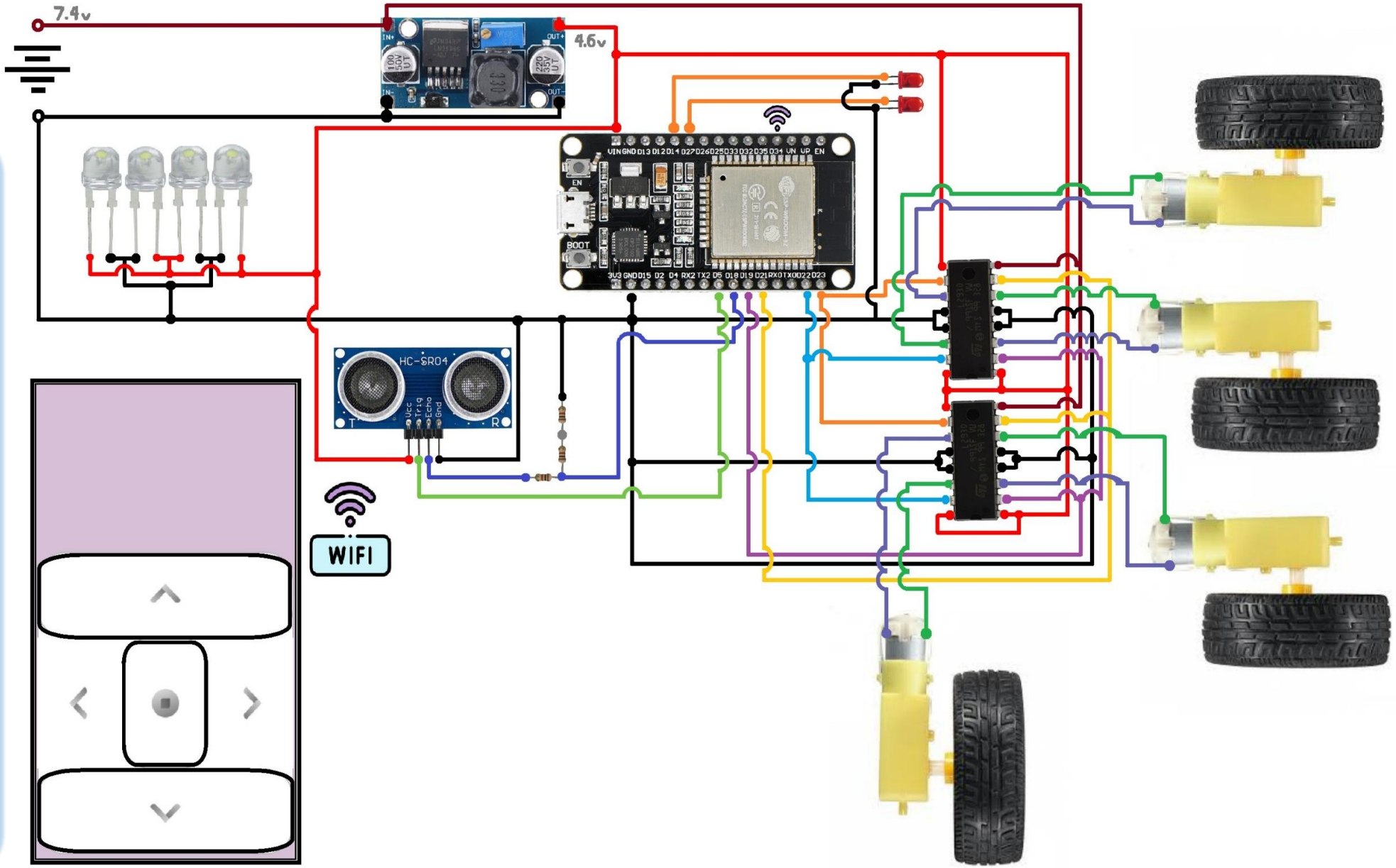
To, briefly understand the circuit, here's the **Circuit Diagram** of the System:

Workflow

The **ESP32 Microcontroller** receives **command's** from the Application over **Wi-Fi**, measures the nearest object distance using,

HC-SR04 ultrasonic sensor, The Microcontroller sends **HIGH** and **LOW** voltage to the **L293D Motor Driver** according the **functions**, and sends Response back to the Application.

The Motor Driver rotates the Motors, **Clock-Wise** and **Anti Clock-Wise** accordingly.

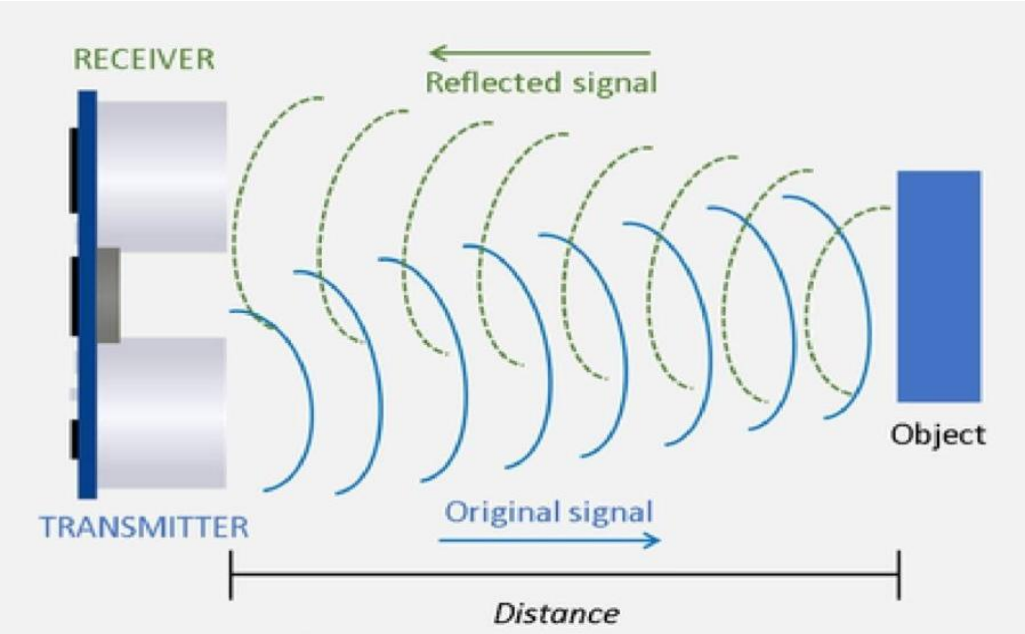


But, How does the **Distance measurements**

is **Happening ?**

- The Transmitter Emits a **8-cycle** burst of **40 kHz** ultrasonic pulses.
- The Receiver catches the **reflected waves** and sends **time latency** to the Microcontroller.

By, Using **SOUND WAVES !**



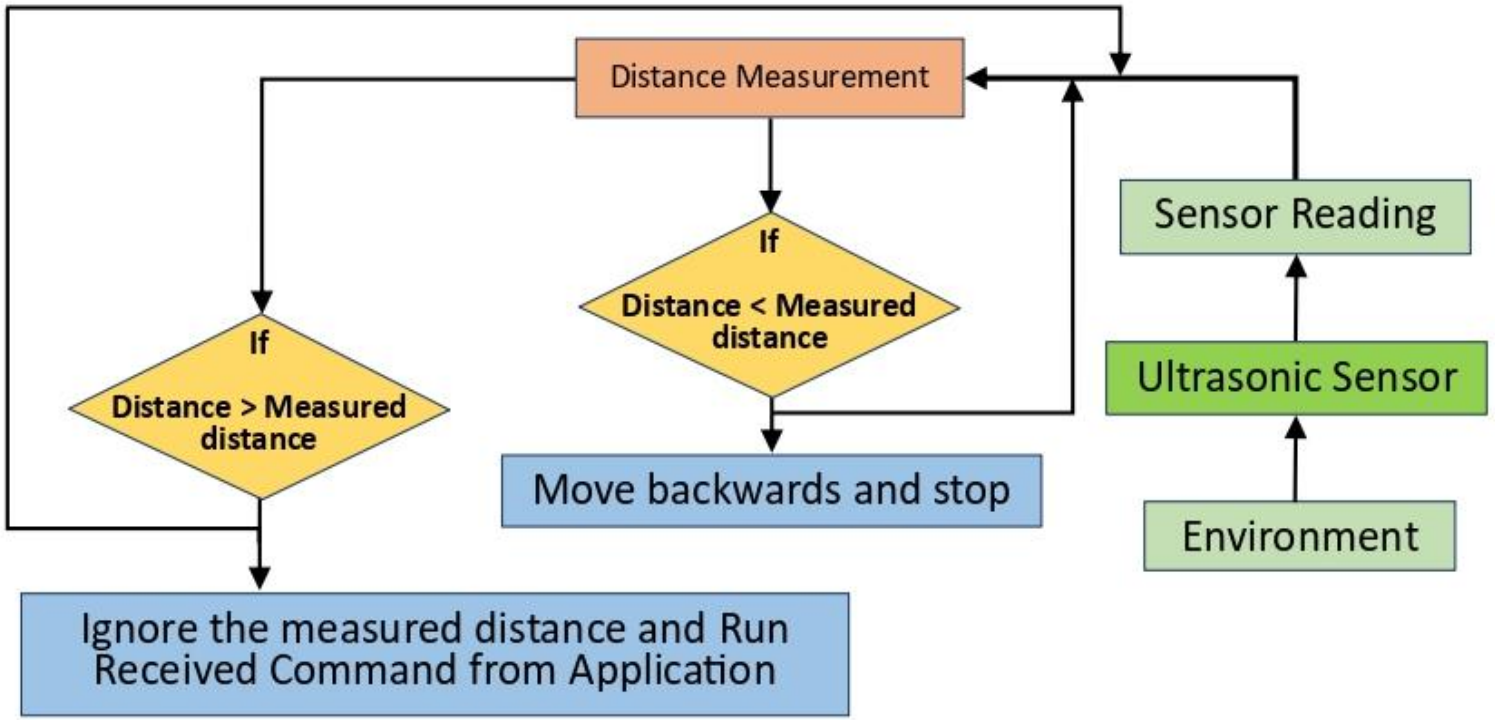
The Microcontroller calculates the distance from given time's by applying sound wave's speed.

If the distance got less than **60 cm**.

[**Distance < 60 cm**]

The Car moves **BACKWARDS** for **0.5 Seconds,**

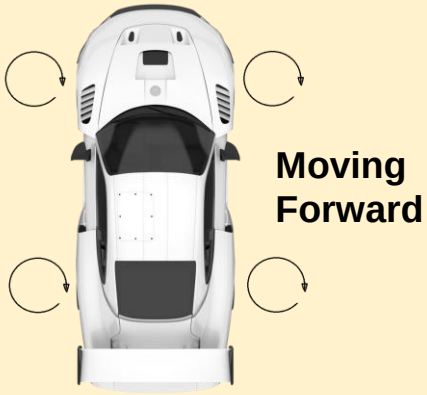
and Moves to **STOP**.



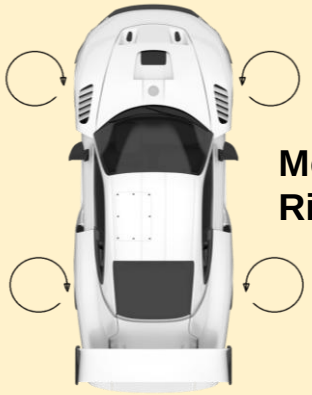
So Basically, the Microcontroller measures distance, receives commands from the Application, runs the **function** accordingly, and sends Voltages remotely to the Motor Driver.

But, How does the **Car** is moving **Left** and **Right ?**

Command	Left Wheel's	Right Wheel's
Forward	Rotates Forward	Rotates Forward
Backward	Rotates Backward	Rotates Backward
Left Turn	Rotates Forward	Rotates Backward
Right Turn	Rotates Backward	Rotates Forward
Stop	Motor OFF	Motor OFF

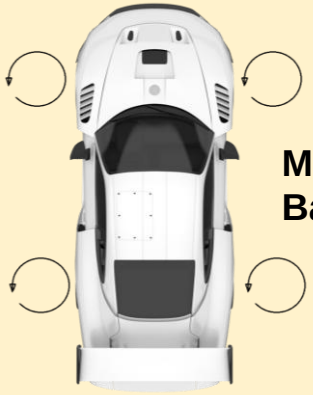


Moving Forward



Moving Right

Moving Left



Moving Backward

Key Features

- **Obstacle detection** within **60 cm** using ultrasonic sensor.
- **Automatic** reverse and stop when obstacles are detected.
- Remote control via **Android app** using **Wi-Fi**.
- **Real-time response** with minimal delay.
- **User-friendly interface** on the application.
- Simple yet **effective collision avoidance** system.

Ensures **collision-free** navigation.

Easy to control using a smartphone.

Real-time movement **response** in Application.

Cost-effective and scalable.

Applications

- Smart **Robotic** systems.
- **Automated** warehouse vehicles.
- Delivery robots.
- **Security** patrolling systems.

Conclusion

The development of the Obstacle Detection Car Controlled by Android Application using ESP32 and Android Studio successfully achieved its primary objective of enabling remote car control using a smartphone app over a Wi-Fi network. By establishing a stable access point using the ESP32, the application effectively sent HTTP GET requests to control the car's movements. The integration of the HC-SR04 ultrasonic sensor allowed for real-time obstacle detection and automatic movement adjustments, enhancing the car's functionality and safety.

Throughout the project, several challenges were encountered and overcome.

The project demonstrated significant learning outcomes, including hands-on experience in embedded systems, Wi-Fi networking, Android application development, and sensor integration.

Overall, the project successfully addressed the initial problem of remote car control using Wi-Fi, providing a responsive and reliable user experience.

Future Scope’s

- Obstacle Avoidance using Computer Vision
- **Integretion with othert Sensor’s**
- AI Integration.

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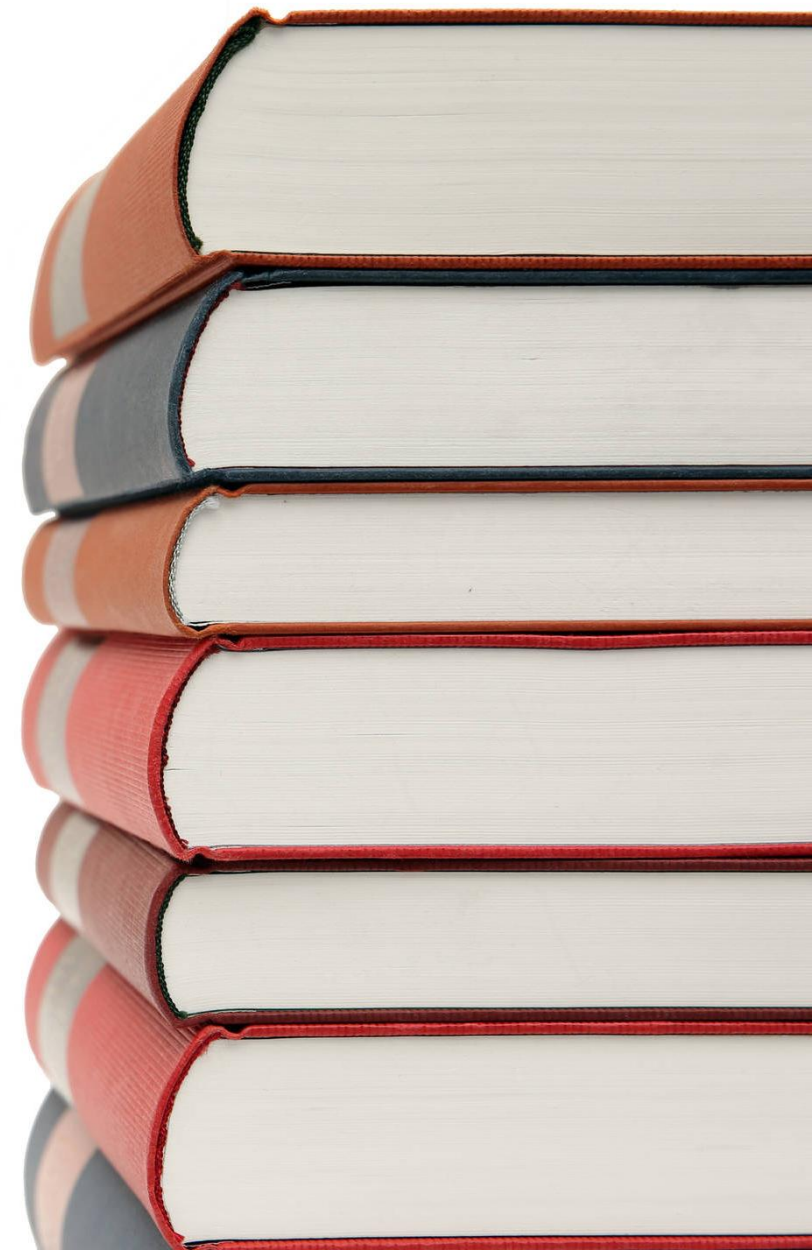

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