

DAVID PUTRA

Gesture Controlled Robot Car Using Arduino

Star Cast

THE TEAM

Know about the team!



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Introduction

THE INTRODUCTION

Let's start the game!

Introduction

- ★ This project is a smart wireless robotic vehicle designed using a Arduino Uno & a Arduino Nano, integrating wireless control, obstacle awareness, motor driving, and intelligent LED signaling.
- ★ The system combines NRF24L01 radio communication, Bluetooth control, a TB6612FNG motor driver, an ultrasonic distance sensor, and NeoPixel RGB LEDs to create a feature-rich and responsive robotic platform.
- ★ The entire system operates using non-blocking logic, ensuring smooth motor control, responsive wireless communication, and stable LED animations without delays.
- ★ Overall, this project demonstrates the integration of embedded systems, wireless communication, sensor-based safety, and visual feedback, making it a strong example of a real-world robotic control system inspired by modern automotive behavior.

Objective

The objective of this project is to design and implement a robotic car that can be controlled using hand gestures through wireless communication.

Key Design Setup

 CODE EDITOR
Arduino IDE + VS Code

 3D MODELLING
Autodesk Fusion

 MOBILE APP
Arduino Bluetooth Control



Little lights demonstration

Architecture

WORKING PRINCIPLES

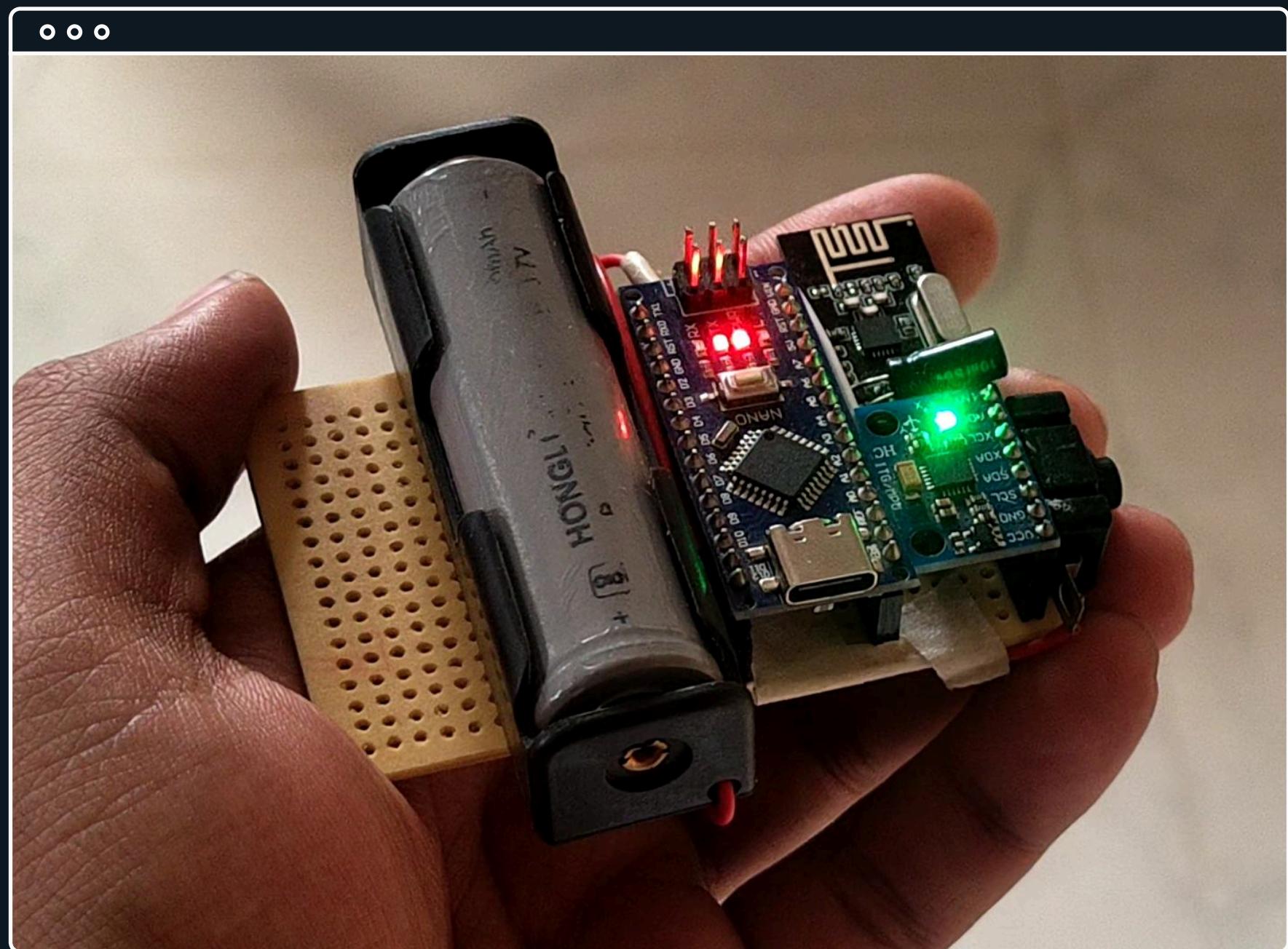
How does it work?

The system consists of two main sections: a transmitter unit and a receiver unit.

Transmitter

- ★ The transmitter unit acts as the gesture controller. It consists of an Arduino Nano, an MPU6050 accelerometer and gyroscope sensor, and an NRF24L01 wireless transceiver.
- ★ The MPU6050 continuously measures acceleration and angular velocity along multiple axes to capture real-time hand orientation. Raw sensor data is filtered and mapped into directional commands such as forward, backward, left, and right.
- ★ The Arduino Nano converts motion thresholds into discrete control signals, reducing noise and unintended movements. Encoded control commands are transmitted at low latency using the NRF24L01 module for responsive vehicle control.
- ★ Wireless communication is optimized for short-range, reliable transmission with minimal packet loss. The transmitter operates in a non-blocking loop, ensuring smooth gesture tracking and consistent data updates.

The remote // Transmitter



Receiver

- ★ The receiver unit is based on an Arduino Uno, interfaced with an NRF24L01 wireless module to receive control commands from the transmitter.
- ★ In addition to NRF communication, an HC-05 Bluetooth module enables direct mobile phone control, allowing flexible operation without the gesture transmitter.
- ★ The Arduino interprets received commands and generates appropriate motor control signals for forward, backward, left, right, and stop movements.
- ★ A TB6612FNG motor driver converts control signals into efficient motor operation with adjustable speed and direction. The motor driver is connected to a 7.4V external battery to run the four geared DC motors.

Receiver

- ★ A front-mounted ultrasonic sensor provides obstacle detection, automatically preventing forward movement when an object is detected. This increases safety of the robot car.
- ★ NeoPixel RGB LEDs provide real-time visual feedback, reflecting vehicle state through indicators and motion-based lighting effects. It also makes the whole car more attractive.
- ★ The receiver operates using non-blocking logic, ensuring smooth motor response, stable wireless communication, and uninterrupted LED animations.

The robot car // Receiver



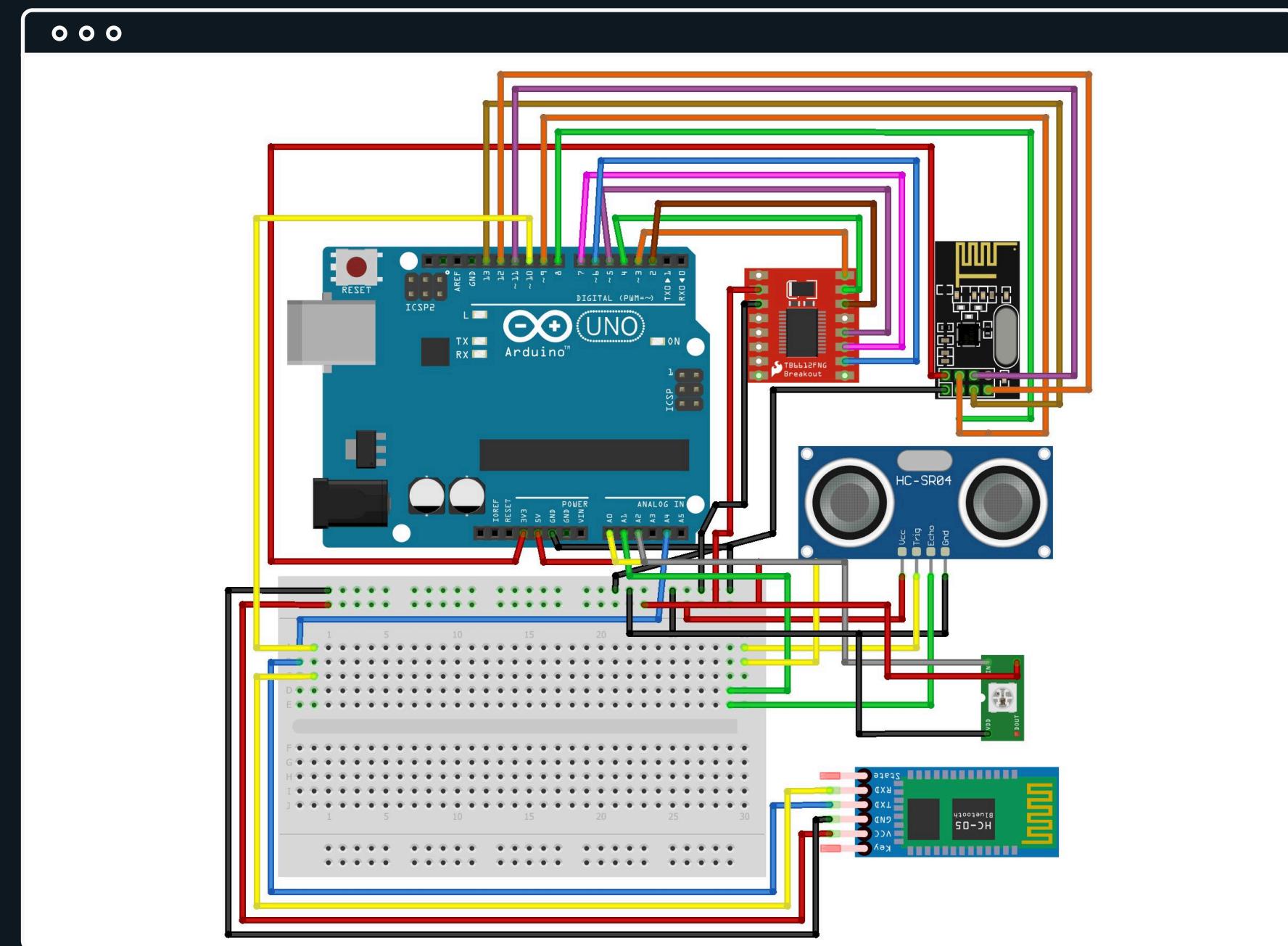
KNOW MUCH MORE!

This document doesn't cover the entire project in details, for that please head over to:
[github/samalsubrat/davidputra](https://github.com/samalsubrat/davidputra)

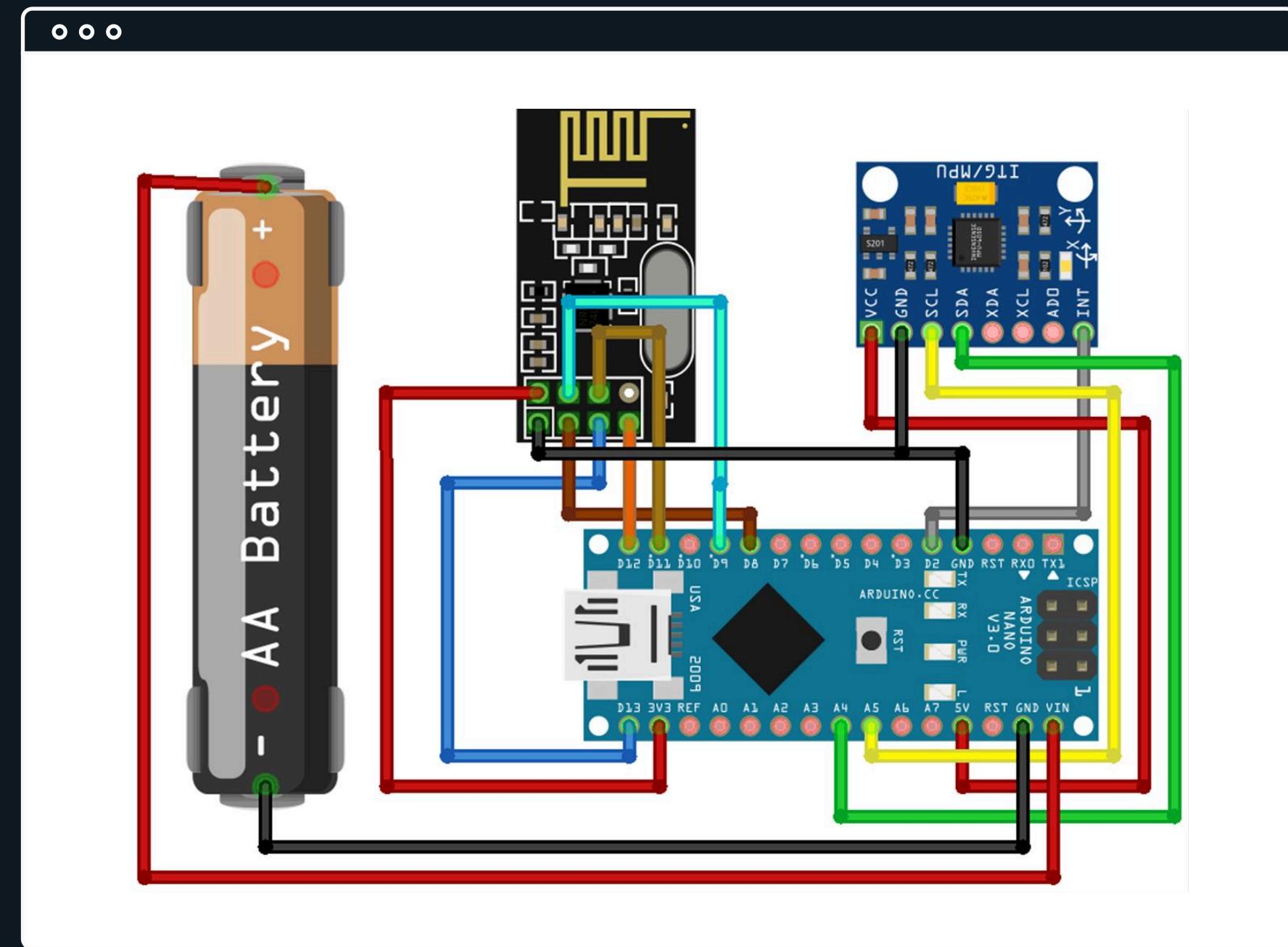
Architecture

Circuit Diagrams of the entire system!

Receiver Circuit Diagram



Transmitter Circuit Diagram



Economics

BILL OF MATERIALS

How much does it cost?

A major idea on the bill of materials

Arduino Uno	Rs 250
Arduino Nano	Rs 200
TB6612FNG	Rs 200
DC Geared Motors	Rs 300
Wheels	Rs 200
18650 Batteries	Rs 240
Battery Holders	Rs 50
NRF24L01	Rs 250
HC-SR04	Rs 120

MPU6050	Rs 180
HC-05	Rs 220
WS2812B NeoPixel Light	Rs 300
3D Printed Case	Rs 550
Wire & Other Parts	Rs 1,000
Total	Rs 4,060

Demonstration

VIDEO

How much does it cost?

Working Demonstration



<https://youtu.be/7BjSHVF1QDA>



Conclusion

CONCLUSION

What do we conclude from
this project?

Conclusion

- ★ Successfully designed a gesture-based transmitter using Arduino Nano, MPU6050, and NRF24L01 to generate intuitive control commands.
- ★ Implemented a receiver unit with Arduino Uno to interpret wireless commands and control vehicle motion. Achieved dual control capability through both gesture input and Bluetooth mobile control.
- ★ Integrated a front-mounted ultrasonic sensor to provide obstacle-aware forward movement for improved safety. Used the TB6612FNG motor driver for efficient and precise motor control.
- ★ Developed automotive-style NeoPixel lighting effects to visually represent motion and system states. Ensured real-time, non-blocking operation for stable communication, motion, and visual feedback.

David Putra

THE END