

# SELF DRIVING CAR

## Project Phase-II

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# Index

-  Problem Statement
-  Journey from Idea to Prototype
-  System Requirements
-  System Architecture Diagram
-  Core Working
-  Working of Self Driving Car
-  Conclusion
-  Future Scope

# Problem Statement

India witnesses one of the highest numbers of road accidents globally, with over 1.5 lakh deaths reported annually due to traffic collisions most caused by human error such as speeding, drunk driving, and distraction.

There is a critical need for an intelligent transportation solution that can operate safely and autonomously under Indian road conditions.



# Journey from Idea to Prototype

*The journey began with a vision*

- I. Reduce road accidents and human error through autonomous technology. Inspired by global leaders like Tesla and challenged by India's unique traffic conditions Due to human errors such as overspeeding, distracted driving .
- II. These alarming statistics highlight the urgent need for technological intervention.We set out to create a cost-effective and adaptable **Self-Driving Car** prototype.



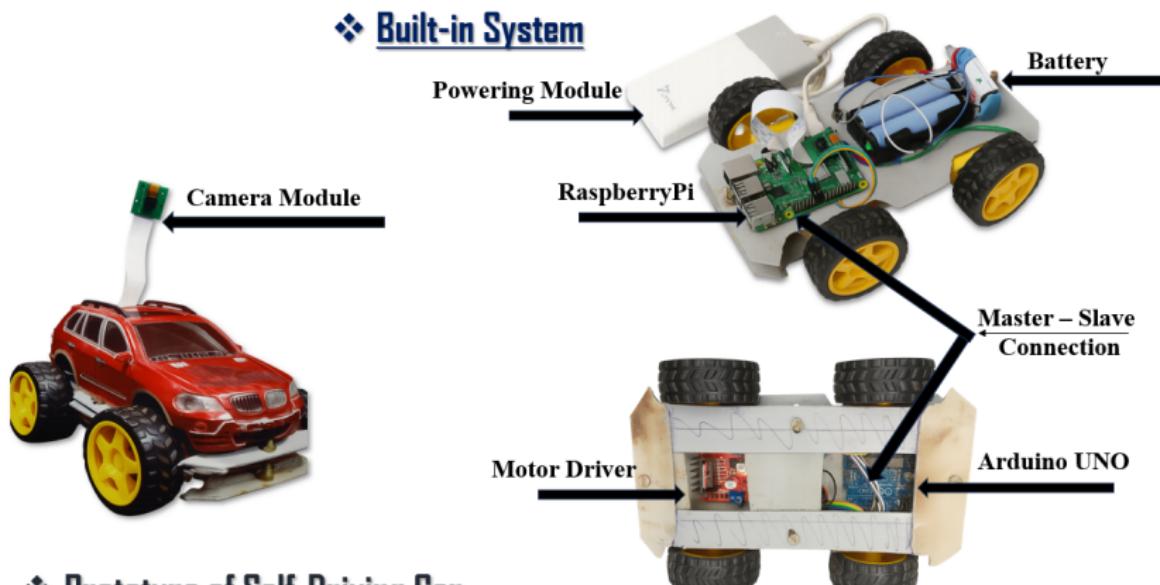
# Introduction

A prototype **Self-Driving Car** that operates autonomously. Core functionalities include object detection, stop sign and control systems to handle steering, braking, and acceleration. The project aims to enhance road safety, optimize traffic, and improve user convenience.



Challenges include real-time data processing, ethical considerations, and regulatory compliance, with the potential to revolutionize transportation through safer and more efficient systems.

# Prototype



# System Requirements

## Software Requirements

- IDE
  - 1. Arduino IDE
  - 2. Raspberry Pi Imager
  - 3. TigerVNC
- Operating System
  - 1. Raspberry Pi OS
- Libraries
  - 1. OpenCV
- Programming Languages
  - 1. Python

## Hardware Requirements

- Arduino Uno
- Raspberry Pi
- Motors
- Camera Module
- Power Bank
- Motors Driver
- Battery

# Hardware Requirements

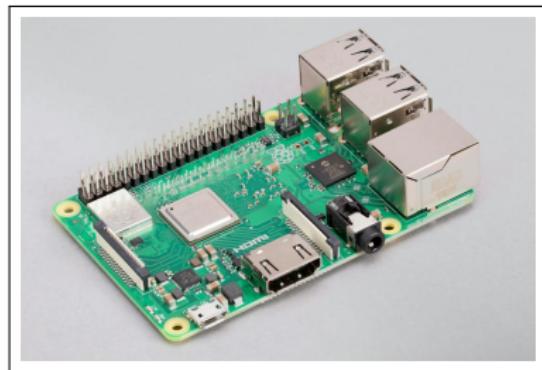
## ARDUINO UNO

- The Arduino Uno is a widely used microcontroller board based on the ATmega328P, designed for beginners and professionals in electronics and programming.
- In a self-driving car project, the Uno plays a crucial role in controlling motor drivers, processing sensor inputs for obstacle detection or line following, and communicating with other devices like a Raspberry Pi for advanced decision-making.



## RASPBERRY PI

- Raspberry Pi runs on an open-source operating system, typically Raspberry Pi OS (a Linux-based distribution), and supports popular programming languages such as Python, C++, and Java.
- In self-driving car projects, the Raspberry Pi is often used to process video feeds from a camera module, run machine learning models for lane and obstacle detection, and make high-level decisions based on input data.

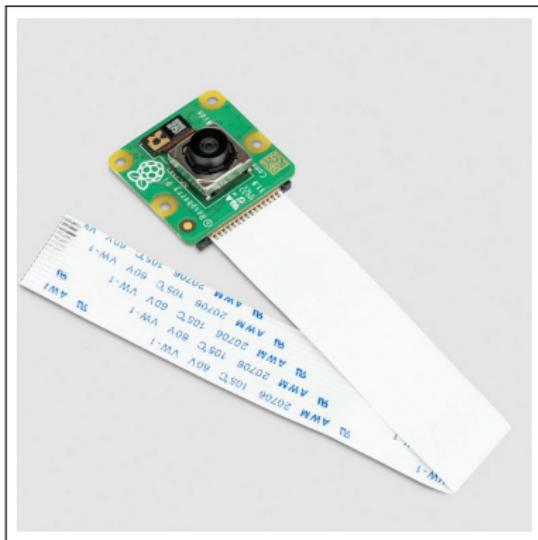


## MOTORS

- Motors are controlled using drivers or controllers, which regulate their speed, direction, and torque.
- In self-driving car projects, motors power the wheels, and their precise control enables smooth navigation.
- They work in conjunction with motor drivers and microcontrollers to execute movement commands, making them a fundamental component of robotic mobility.

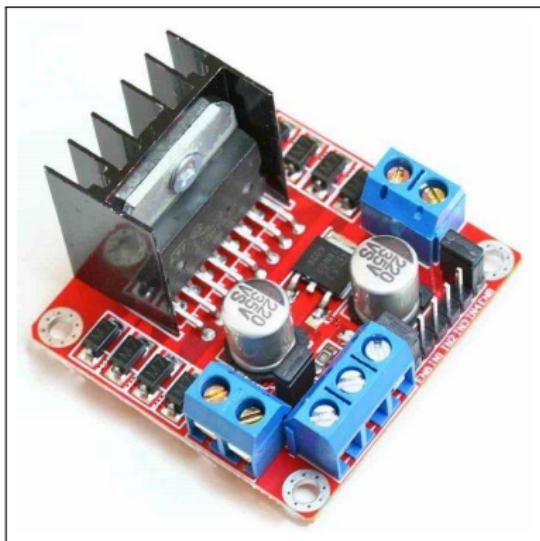


## CAMERA MODULE



- The Raspberry Pi Camera Module is an add-on peripheral designed to work seamlessly with Raspberry Pi boards, enabling high-quality video and image capture.
  - The camera module is essential for capturing live video feeds, which are processed by the Raspberry Pi for tasks like lane detection, obstacle recognition, and traffic sign identification.

## MOTOR DRIVER



- The motor driver (L298N) acts as a bridge between the controller (Arduino or Raspberry Pi) and the DC motors, enabling the car to move forward, backward, or turn.
- It allows safe and efficient control of motor speed and direction using low-power signals.
- It plays a crucial role in translating the car's driving decisions into actual wheel movements.

# Software Requirements

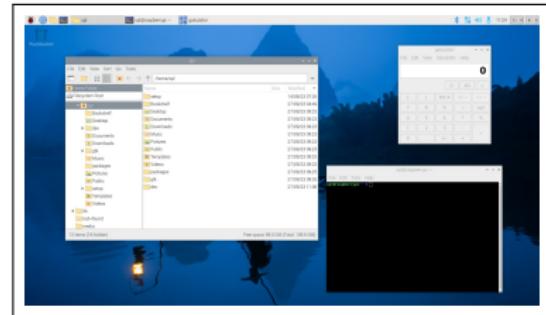
## ARDUINO IDE

- The Arduino IDE (Integrated Development Environment) is a software platform used for writing, compiling, and uploading code to Arduino boards
- The Arduino IDE supports a simplified version of C/C++ programming.
- It comes with an extensive library of built-in functions and pre-written libraries for easy integration with a wide range of hardware, such as sensors, motors, LEDs, and communication modules.



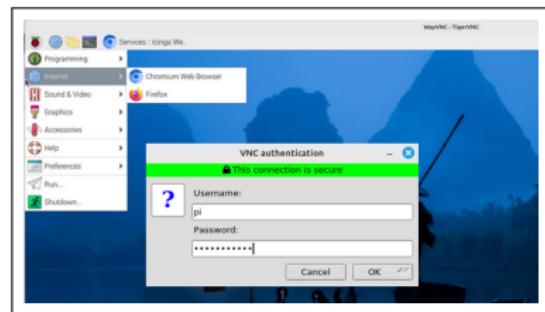
## RASPBERRY PI OS

- Raspberry Pi OS (formerly known as Raspbian) is the official operating system for Raspberry Pi single-board computers.
- It is a Linux-based operating system, optimized specifically for the Raspberry Pi hardware.
- Raspberry Pi OS is free, open-source, and comes with a range of pre-installed software, making it an excellent choice for both beginners and advanced users.

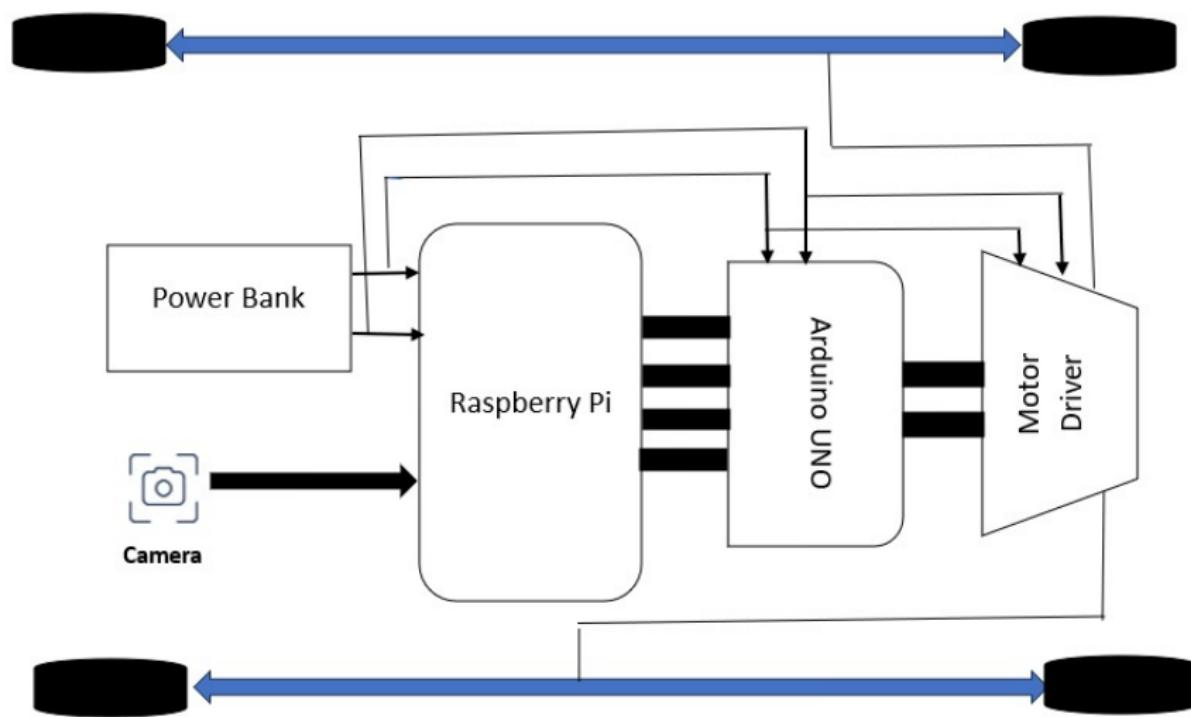


## TIGER VNC

- TigerVNC (Tiger Virtual Network Computing) is an open-source, high-performance implementation of VNC (Virtual Network Computing) that allows you to remotely control another computer's desktop environment using a graphical interface.
- TigerVNC was integrated to enable remote GUI access to the Raspberry Pi-based system, allowing real-time monitoring, debugging, and control of the application without the need for a dedicated display. This reduced setup complexity and enhanced development efficiency.

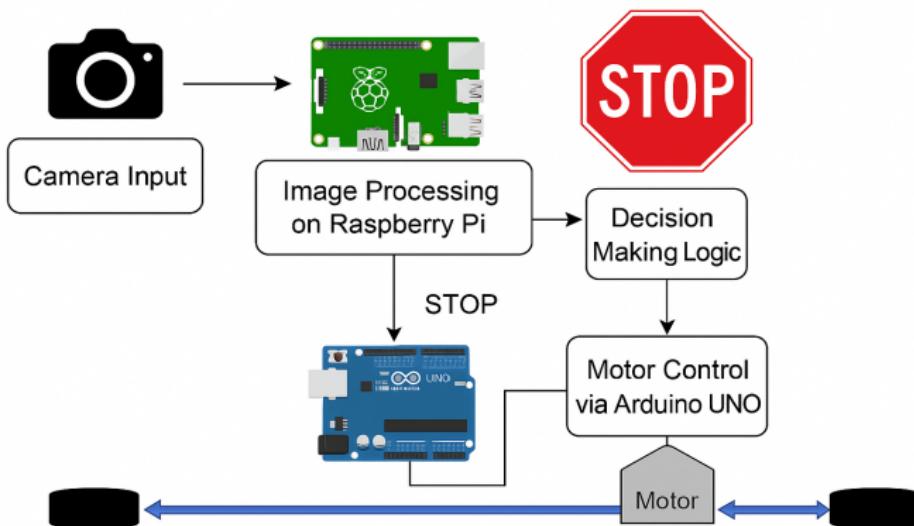


# System Architecture of Self-Driving Car

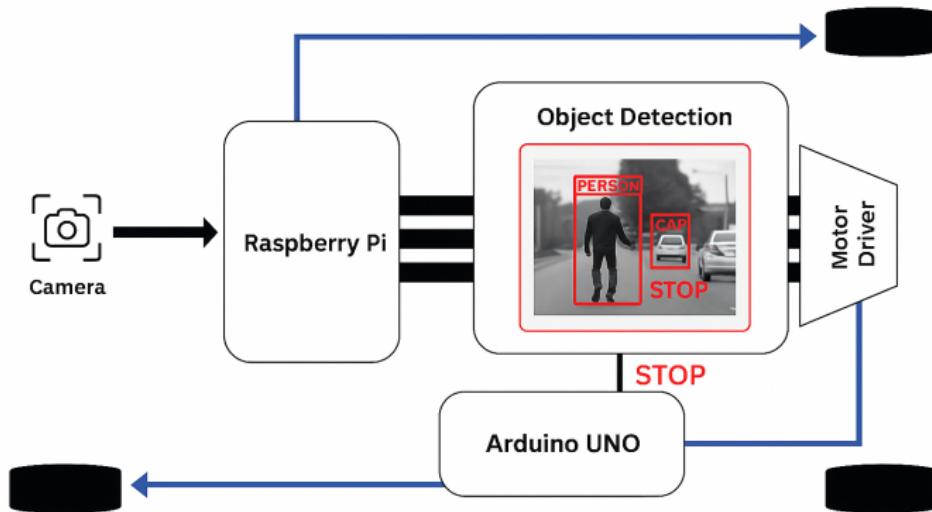


# Core Working of Self-Driving Car

## Core Working: Stop Sign Detection in Self-Driving Car



## CORE WORKING: OBJECT DETECTION

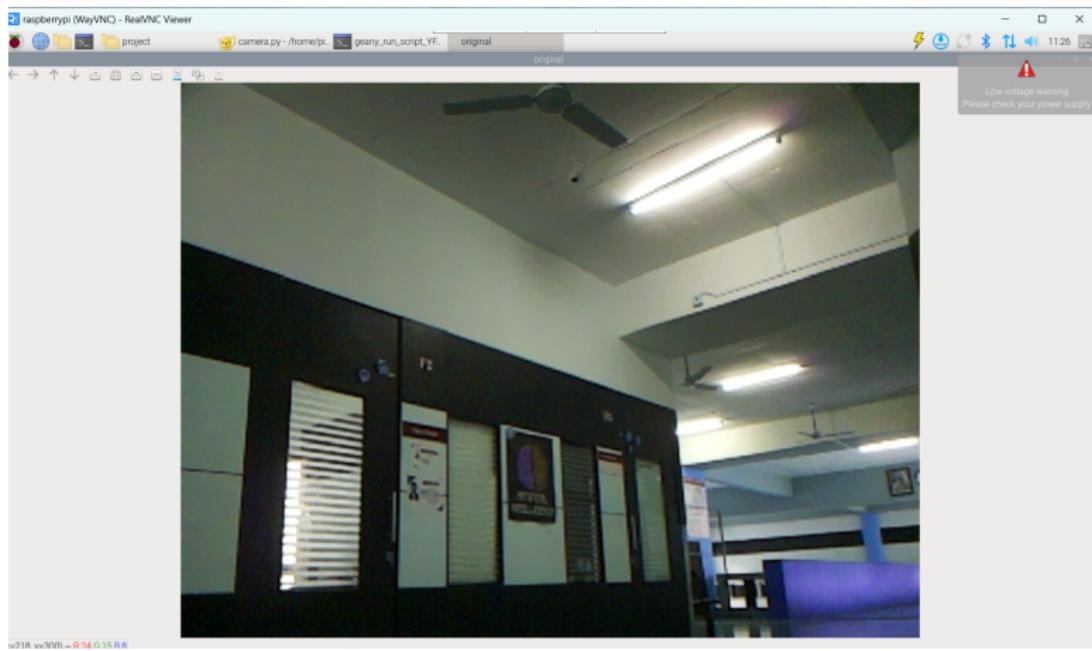


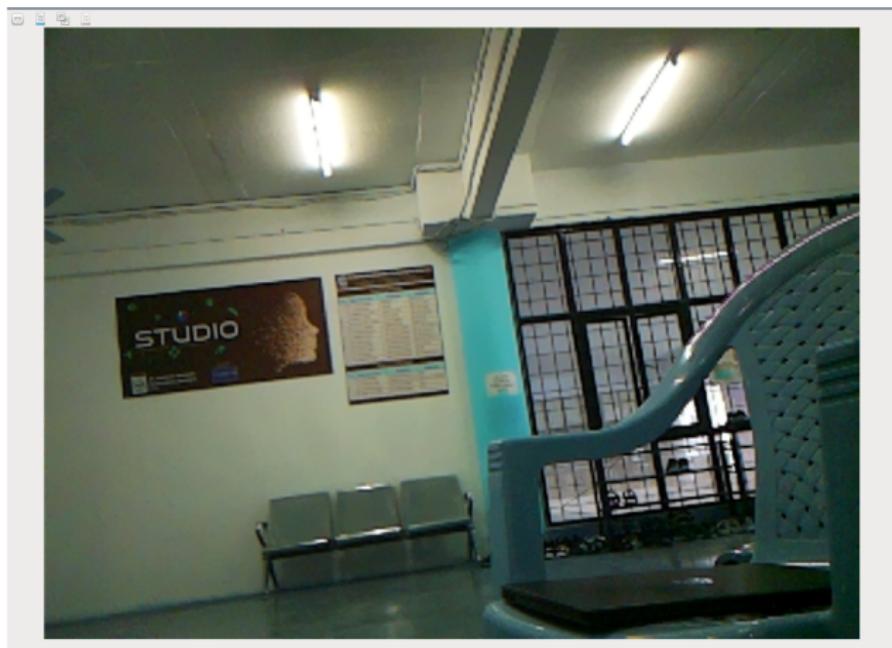
# Result Analysis

## Prototype of Self-driving Car

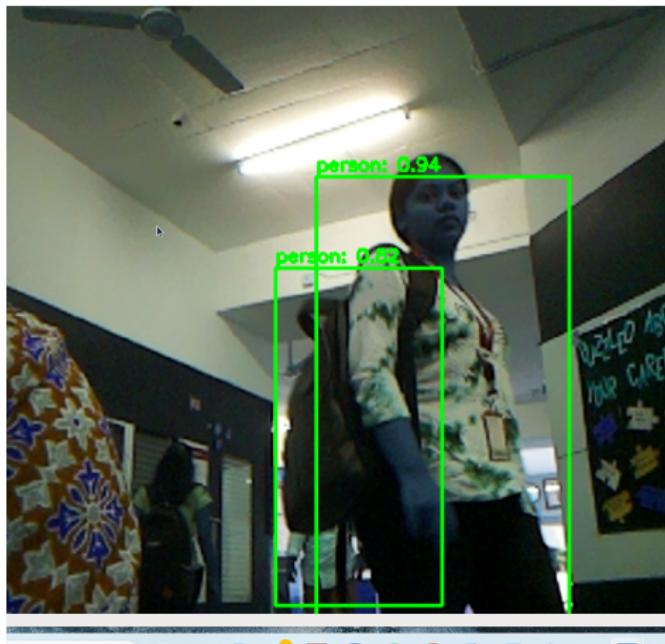


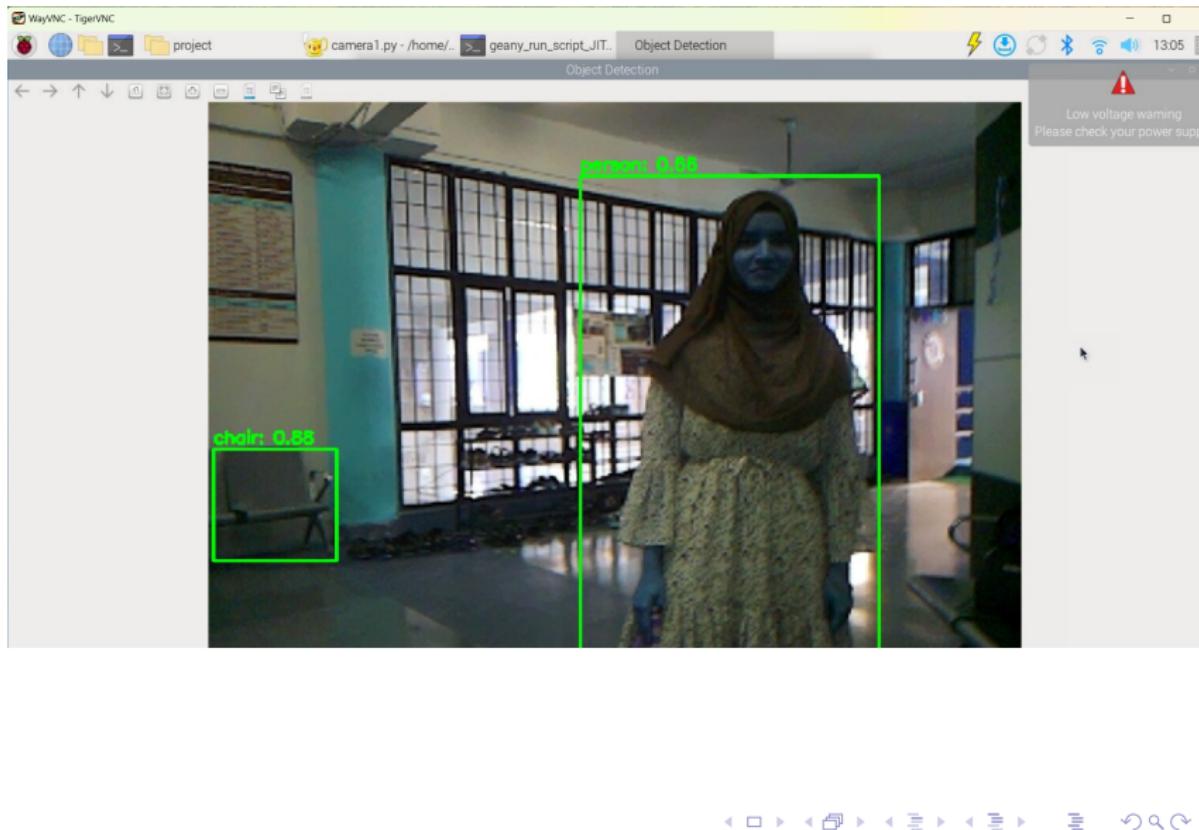
# Image Capturing using Camera Module



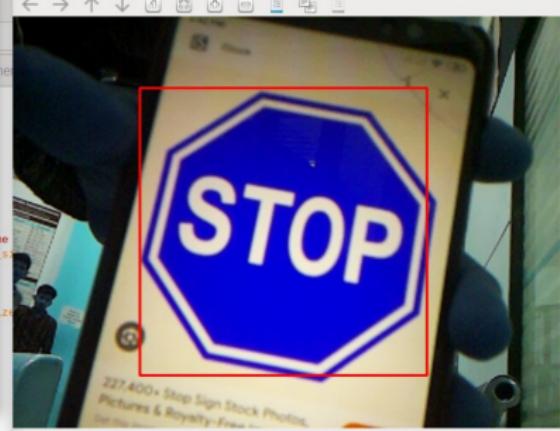


## *Object Detection using Raspberry Pi*





## Stop Sign Detection

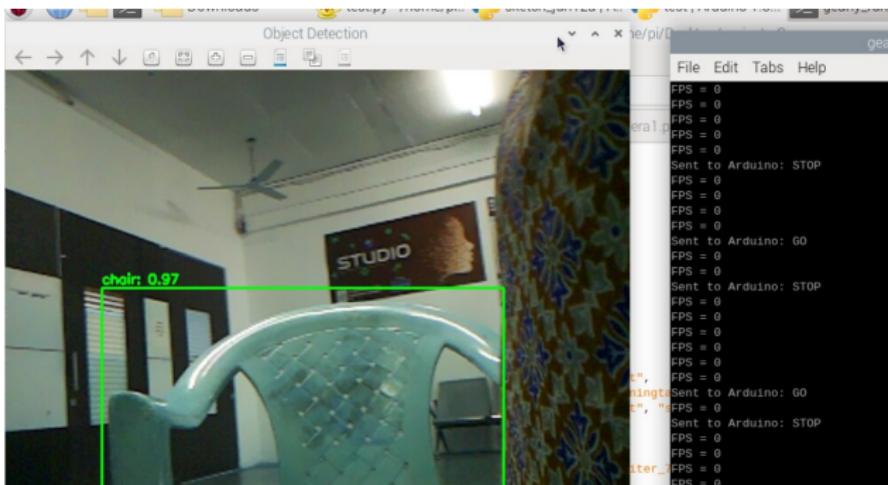


Raspberry Pi Camera - Object Detection

geany\_run\_script\_BWD072.sh

```
File Edit Tabs Help
Sent to Arduino: STOP
Sent to Arduino: GO
Sent to Arduino: GO
Sent to Arduino: GO
Stop Sign Detected!
Sent to Arduino: STOP
Stop Sign Detected!
Sent to Arduino: STOP
Sent to Arduino: GO
Stop Sign Detected!
Sent to Arduino: STOP
Sent to Arduino: STOP
    except Exception as e:
        print(f"Serial Error: {e}")
```

## ***Object Detection using Arduino and Raspberry Pi***



# Conclusion

This project successfully demonstrates a "Self-driving car" system using Raspberry Pi, Arduino, and object detection. It identifies objects like stop signs and responds by stopping the vehicle, showcasing the integration of computer vision and embedded systems. The prototype proves the feasibility of low-cost autonomous navigation and lays the groundwork for future enhancements such as GPS integration, advanced AI models, and real-time IoT connectivity.

# Future Scope

1. Future advancements in AI algorithms, sensor technology, and predictive analytics will further enhance the ability of self-driving cars to identify and respond to road hazards, reducing accident rates to near-zero levels.
2. The use of more sophisticated ML models, such as reinforcement learning and deep learning, can improve the decision-making capabilities of self-driving systems.
3. Future self-driving cars can focus on providing personalized experiences for passengers, such as customized entertainment systems, automated navigation preferences, and health monitoring during travel.

THANK  
YOU!

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