VEHICLE NUMBER PLATE DETECTION

A MINI-PROJECT REPORT

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in partial fulfillment for the award of the degree

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BONAFIDE CERTIFICATE

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Submitted for the Viva-voce on___________

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

Recognizing vehicle number plates is a difficult but much needed system. This is very useful for automating toll booths, automated signal breakers identification and finding out traffic rule breakers. Here we propose a Raspberry Pi based vehicle number plate recognition system that automatically recognizes vehicle number plates using image processing. The system uses a camera along with LCD display circuit interfaced to a Raspberry pi. The system constantly processes incoming camera footage to detect any trace of number plates. On sensing a number plate in front of the camera, it processes the camera input, extracts the number plate part from the image. Processes the extracted image using OCR and extracts the number plate number from it. The system then displays the extracted number on an LCD display. Thus we put forward a fully functional vehicle number plate recognition system using Raspberry Pi. The proposed system offers a versatile and cost-effective solution for automating the detection and recognition of vehicle number plates in various environments, including urban areas, parking facilities, and transportation hubs.

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CHAPTER-1

INTRODUCTION

Vehicle number plate detection is a crucial aspect of modern transportation systems, playing a pivotal role in various applications such as security, law enforcement, and traffic management. With the advancements in computer vision, machine learning, and IoT technologies, automated systems capable of accurately detecting and recognizing vehicle number plates have become increasingly feasible and effective.

The process of vehicle number plate detection involves the use of cameras or sensors to capture images of vehicles as they pass through designated checkpoints or surveillance areas. These images are then analysed using sophisticated algorithms to extract the number plates and interpret the alphanumeric characters displayed on them. The ability to automatically detect and recognize vehicle number plates offers numerous benefits. It enables law enforcement agencies to efficiently monitor traffic violations, such as speeding or running red lights, by automatically identifying offending vehicles. Moreover, in the context of security, it facilitates the tracking of vehicles involved in criminal activities or unauthorized entry into restricted areas. Furthermore, in urban environments with heavy traffic congestion, real-time vehicle number plate detection can aid in optimizing traffic flow and managing parking spaces more effectively. By providing insights into vehicle movements and occupancy rates, authorities can make informed decisions to alleviate congestion and enhance overall transportation efficiency.

In recent years, the integration of IoT devices, such as Raspberry Pi boards, with sophisticated image processing algorithms implemented in Python, has enabled the development of cost-effective and scalable solutions for vehicle number plate detection. These systems leverage the computational power of IoT devices to perform real-time analysis of captured images, making them suitable for deployment in various environments, from busy city streets to remote highways.

CHAPTER-2

LITERATURE SURVEY

A literature review is a text written by someone to consider the critical points of current knowledge including substantive findings as well as theoretical and methodological contribution to a particular topic. This section provides the essential contributions and techniques that are recently developed for accurately identification of vehicle number plate.

Sandipan Chowdhury et al [4] proposes calculations to confine vehicle number plates from regular foundation pictures, to fragment the characters from the restricted number plates and to perceive the sectioned characters. The revealed framework is tried on a dataset of 560 specimen pictures caught with various foundations under different enlightenments. The execution exactness of the proposed framework has been computed at each stage, which is 97.1%, 95.4% and 95.72% for confinement and extraction, character division and character acknowledgment individually. The proposed strategy is likewise equipped for limiting and perceiving numerous number plates in pictures.

Sahar S. Tabrizi et al [5] presents another technique for Iranian License plate acknowledgment frameworks that will expand the exactness and lessening the expenses of the acknowledgment period of these frameworks. In such manner, a mixture of the k-Nearest Neighbors calculation and the Multi-Class Support Vector Machines (KNN-SVM) model was produced in the review. K-NN was utilized as the primary characterization display as it is basic, vigorous against uproarious informational collection and powerful for a substantial informational index. The perplexity among the tag comparative characters issue was overcome by utilizing the various SVMs characterization display. The SVMs show has enhanced the execution of the K-NN in the acknowledgment of comparative characters. The present review test comes about uncovered that there is a huge change in the character acknowledgment stage rate contrasted and a comparable review.

TejendraPanchal et al [6] address License Plate limitation with the incorporated division approach. As the noteworthiness of open travel system constructs an Automatic License Plate Recognition has wound up being a basic investigation subject. ALPR outfitted with various sharp perception structures like, road movement organization, security organization, modified toll gathering system, et cetera. Different frameworks have been offered for tag acknowledgment, each bearing its own specific purposes of intrigue and blocks. The critical stride in ALPR framework is the exact repression of number plate, Segmentation, Recognition. Harris corner calculation is proposed in this paper which wind up being powerful in changing movement and enlightened lightning conditions. While the exactness of License Plate confinement is nourished forward to the Segmentation organize. The Segmentation is refined by a strategy for associated segment investigation solidified with Pixel check, Aspect proportion and Height of characters. At the end, the reenacted results are appeared with conclusion and future work.

Tag acknowledgment framework for stolen vehicles and recovery of proprietor's subtle elements is produced by **UtkarshaGurjar et al [7]** utilized for distinguishing the stolen vehicles and is actualized at police checkpoints and toll square. Additionally fundamental subtle elements of enlisted clients can be recovered. This framework essentially comprises of three modules: tag confinement, character division and character acknowledgment. The proposed framework first catches the picture of vehicle utilizing the camera and concentrates the tag number utilizing the ideas of advanced picture handling. At that point it approves the tag number against the database containing the subtle elements of substantial tag numbers. On the off chance that it is found in the legitimate tag database then it will check in the stolen auto database and a ready message is appeared if match is found.

In this paper, **PooyaSagharichi Ha et al [8]** exhibit an Automatic License Plate Recognition System (ALPRS) to distinguish tags which is an utilization of picture preparing. The primary procedure of ALPRS is isolated into four stages: The clamor in the picture is expelled by utilizing FMH channel. A straightforward calculation is utilized for foundation subtraction. Shrewd edge identification is utilized to limit the tag area. At last, letters and digits are separated through format coordinating strategy. The proposed calculations have two preferences: First, the technique has solid strength against commotion. Second, it can manage tags with various hues. The execution of the calculation is tried in an ongoing video stream. In view of the outcome, our calculation demonstrates the missing rate is right around 16% from 70 vehicle pictures.

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EXISTING SYSTEM

Human resource-based number plate detection relies heavily on manual intervention for identifying and recording vehicle details, often leading to inefficiencies and human errors. In this process, traffic officials or operators manually review CCTV footage of ongoing traffic to identify instances of traffic rule violations. When a violation is observed, such as a vehicle breaking a traffic rule, the operator must manually extract the vehicle's number plate information from the captured screenshot of the CCTV footage.

This manual extraction process requires significant human effort and time, as operators need to carefully review each frame of the footage to locate and extract the number plate details accurately. Additionally, it is prone to errors due to factors such as poor image quality, occlusions, or variations in lighting conditions, which can affect the readability of the number plate.Once the number plate information is extracted, it is recorded in the system's records, and appropriate actions, such as issuing e-challans or generating violation reports, are taken based on the recorded information.

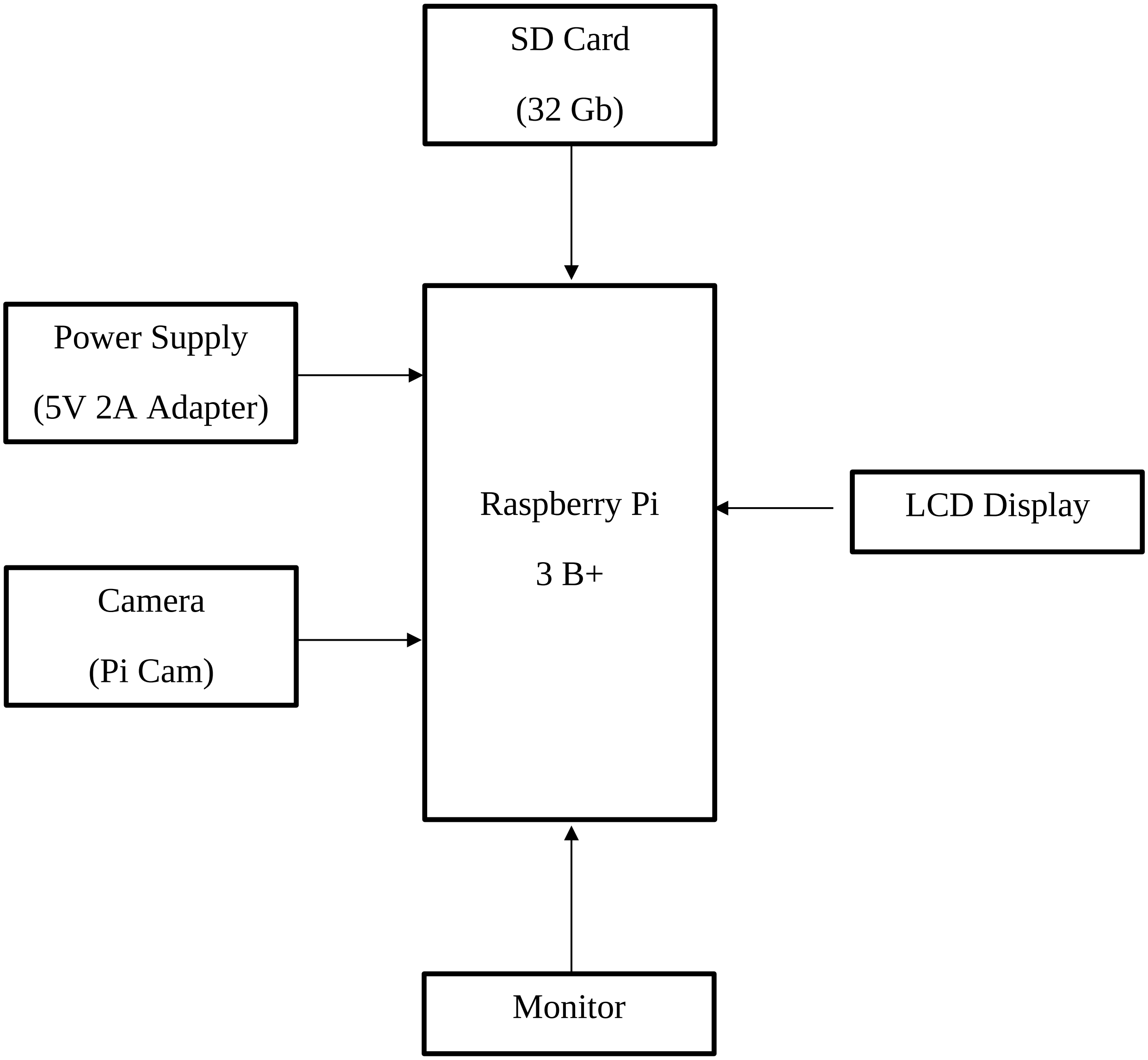
However, this manual process is resource-intensive, time-consuming, and susceptible to inaccuracies. It relies heavily on the availability of trained personnel to review the footage and extract the number plate details accurately. Moreover, it may result in delays in issuing penalties or taking corrective actions, as it depends on the speed and efficiency of human operators.

In summary, human resource-based number plate detection involves manual review and extraction of number plate information from CCTV footage, which can be inefficient, error-prone, and time-consuming. As such, there is a need for more automated and efficient solutions, such as algorithmic approaches leveraging image processing and machine learning techniques, to streamline the process and improve accuracy and efficiency in vehicle number plate detection.

CHAPTER-4

PROPOSED SYSTEM

BLOCK DIAGRAM:



WORKFLOW PROCESS:

HARDWARE SETUP:

First, ensure you have all the necessary hardware: the Raspberry Pi with a memory card, a phone with a camera, a laptop, an LCD display, and a power adapter. Connect the memory card to the Raspberry Pi, plug in the adapter, and connect the necessary peripherals. Power up the Raspberry Pi and connect it to your Wi-Fi network. Connect the LCD display to the Raspberry Pi for visual feedback. Configure the Raspberry Pi to process images and detect number plates.

SOFTWARE SETUP:

First, ensure your Raspberry Pi is running Raspberry Pi OS, and you have RealVNC Viewer installed on your laptop for remote access. Connect your laptop and Raspberry Pi to the same Wi-Fi network. Next, use Python 3 IDLE to write and run your number plate detection code on the Raspberry Pi. This code will communicate with the phone camera to capture images of vehicle number plates. Install any necessary Python libraries for image processing and computer vision. Configure RealVNC Viewer to remotely access the Raspberry Pi from your laptop. Connect the LCD display to the Raspberry Pi for visual feedback. Once everything is set up, you can remotely access the Raspberry Pi from your laptop using RealVNC Viewer, run your Python code for number plate detection, and view the results on the LCD display.

- **Raspberry Pi (Client) Code**

The client code running on the Raspberry Pi is responsible for capturing an image of a vehicle's number plate and sending this image to a server for further processing

```
import lcd_display as ld
import socket



def client_():
 host = '192.168.43.239'
 port = 1234
 client_socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)

 try:
    while True:
        client_socket.connect((host, port))
        print("Connection successful")

        file_path = "/home/numplate/Desktop/aa.jpg"  # Ensure this path is correct and points to the
file you want to send

        with open(file_path, 'rb') as f:  # Open the file in binary mode
            data = f.read()
            client_socket.sendall(data)
        print("Data sent")

 except Exception as e:
    print(f"Error: {e}")

 finally:
    client_socket.close()
    print("Connection closed")
 return


def displaying(text,line,delay,clean=True,cl_line=3):
    #ld.lcd_show(text,line,delay)
    if clean ==True:
     #ld.lcd_clean(cl_line)
        pass
    return


if _name_ == "_main_":

    con = [16,7,8,25,24,23,18]
    #ld.variables(con)

    texts = ["Booting","initiated.......!","Welcome!......      ","..............","number
plate","detection","Developed by","Suman","Swetha","Udhayashree","Vishal","Sabari","Ram
Kumar","Booting","completed"]

    for num in range (0,len(texts),2):
        displaying(texts[num],1,0,clean=False)
        displaying(texts[num+1],2,2,clean=True,cl_line=3)

    client_()
```

- **Laptop (Server) Code**

The server code running on the laptop is responsible for receiving the image sent by the client, processing it to detect the number plate using AI models, and extracting the text from the detected number plate

```
from ultralytics import YOLO
from io import BytesIO
from PIL import Image
import urllib.request
import numpy as np
import easyocr
import socket
import shutil
import os


def server_():
    host = '192.168.43.239'  # Server's IP address
    port = 1234

    server_socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    server_socket.bind((host, port))
    server_socket.listen(1)
    print(f"Server listening on {host}:{port}")

    try:
        connection, client_address = server_socket.accept()
        print(f"Connection from {client_address} established")

        data_received = b''
        while True:
            data = connection.recv(1024)
            if not data:
                break
            data_received += data

            file_path = "D:\\Numplate\\img.jpg"  # Ensure this path is correct and points to where you
want to save the received file
            with open(file_path, 'wb') as f:  # Open the file in binary mode
                f.write(data_received)
                print("Data written to file")

    except Exception as e:
        print(f"Error: {e}")

    finally:
        connection.close()
        server_socket.close()
        print("Server connection closed")


def AI_detection_():
    image = Image.open("D:\\Numplate\\img.jpg")
    resized_image = image.resize((640,640))
    results = model(source = resized_image,conf = 0.6,save_crop = True)
    text_converter()
    return


def text_converter():

    try:
        model="D:\\Numplate\\english_g2"
        reader = easyocr.Reader(['en'], model_storage_directory=model, download_enabled=False,
gpu=False)
        image_path =""
        result = reader.readtext(image_path)
        extracted_text = ' '.join([text[1] for text in result])

    except:
       extracted_text = "not detected"

    finally:
        shutil.rmtree('E:\\others\\data_set_for _AI\\data_car\\runs\\detect')
        os.remove("img.jpg")

    print(extracted_text)
    global text
    text = extracted_text
    return


if _name_ == "_main_":

    model = YOLO("number_best.pt")
    reader = easyocr.Reader(['en'])
    server_()
```

NUMBER PLATE DETECTION ALGORITHM:

Capture images using the camera module and preprocess them to enhance quality and reduce noise.Use techniques like Haar cascades or deep learning models (e.g., YOLO, SSD) to detect vehicles in the images. Apply image processing techniques to localize the number plate region within the detected vehicle. Character Segmentation: Segment individual characters from the number plate region for recognition.

NUMBER PLATE RECOGNITION:

In vehicle number plate detection, number plate recognition is the process of accurately identifying and interpreting the characters on a vehicle's number plate within an image. It begins with capturing an image of the vehicle and its number plate. The image undergoes preprocessing to improve quality, then the algorithm locates the number plate region. Individual characters are segmented and extracted, and Optical Character Recognition (OCR) algorithms recognize the characters. The recognized characters are compiled to form the complete number plate information. This step is crucial for the system to accurately identify vehicles based on their number plates.

INTEGRATION AND TESTING:

Integration and testing in number plate detection involve putting together all the parts of the system and making sure they work well together. It's like assembling a puzzle to see the bigger picture. Testing means checking if each piece works as expected and if the whole system accurately detects number plates. It's like making sure each part of a machine functions properly before it's put to use. This process helps ensure that the system is reliable and performs well in real-world situations.

USER INTERFACE(OPTIONAL):

In number plate detection, the user interface (UI) is how users interact with the system. It's like a dashboard where users can input commands, adjust settings, and see results. The UI should be easy to use and understand, with clear buttons and displays. It's like a user-friendly menu on a smartphone that helps users navigate and control the system without confusion.

DEPLOYMENT:

Deployment in number plate detection is about putting the system into action. It's like setting up a traffic camera on the street. Once everything's ready, the system is tested to make sure it works properly. Then, it's installed where it's needed, whether it's a parking lot or a highway. After deployment, the system is regularly checked to keep it running smoothly, just like how traffic cameras are maintained to ensure they capture accurate information.

OPTIMIZATION AND PERFORMANCE TUNING:

Optimization and performance tuning in number plate detection involve making the system work faster and more efficiently. It's like fine-tuning a car engine to get the best performance. This process includes tweaking algorithms, adjusting settings, and optimizing code to reduce processing time and improve accuracy. It's like streamlining operations to make them run smoother and quicker. By optimizing the system, it can detect number plates more quickly and accurately, making it more reliable for real-world use.

MAINTENANCE AND UPDATES:

Maintenance and updates in number plate detection involve keeping the system running smoothly over time. It's like regularly servicing a car to ensure it stays in good condition. Maintenance includes tasks like checking hardware for any issues, updating software to fix bugs or add new features, and ensuring that the system is secure against any threats. It's like taking care of the engine, tires, and other parts of a car to keep it safe and reliable. By performing regular maintenance and updates, the number plate detection system can continue to function effectively and meet the needs of its users.

CHAPTER-5

HARDWARE DESCRIPTION

RASPBERRY PI:

The Raspberry Pi 3 Model B+ is a powerful and versatile single-board computer renowned for its compact size and impressive performance capabilities. Equipped with a 1.4GHz quad-core ARM Cortex-A53 processor and 1GB of RAM, it offers significant computing power for a wide range of applications. The built-in wireless LAN and Bluetooth connectivity make it easy to connect to networks and peripherals, while the Gigabit Ethernet port ensures high-speed wired networking. With a plethora of GPIO pins and ports, including HDMI, USB, and CSI camera interface, the Raspberry Pi 3 B+ facilitates seamless integration with various hardware components and peripherals, enabling diverse projects in fields such as IoT, robotics, home automation, and education. Its compatibility with a range of operating systems, including Raspbian (now known as Raspberry Pi OS), allows for flexibility and customization to suit different project requirements. Overall, the Raspberry Pi 3 Model B+ continues to be a favorite among hobbyists, educators, and professionals alike, empowering innovation and creativity in the world of computing**.**

MEMORY CARD:

Memory cards are like the brain and storage space of vehicle number plate detection systems. They hold the operating system (OS), which is like the computer's software backbone. Additionally, they store the special software needed for detecting number plates, like algorithms and programs for analyzing images. These cards also keep track of the captured images or videos of vehicles. They're handy for making backups of important system files and settings too. So, in short, memory cards are vital for making sure the system runs smoothly and can do its job of recognizing number plates effectively.

MONITOR:

Monitors are vital in vehicle number plate detection systems, serving as the main interface for operators. They display live camera feeds, detection results, and alerts. Operators use monitors to watch traffic, review captured images, and check system status. In essence, monitors help operators interact with the system and ensure smooth operation.

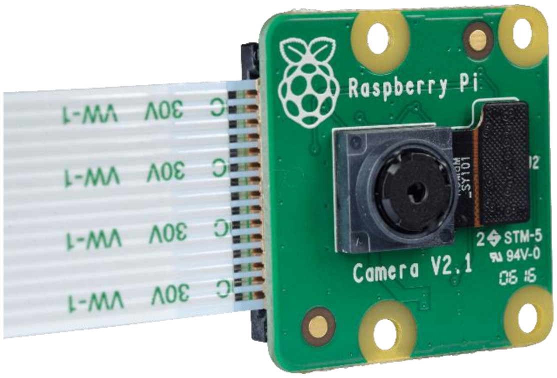
LCD DISPLAY:

LCD display is an essential component of vehicle number plate detection systems, serving as visual interface for operators. It functions like small screen, presenting important information clearly. Operators can monitor real-time traffic by viewing live camera footage on the display. When a vehicle passes by, the LCD shows if the system successfully captures and recognizes its number plate. If there's an issue, like a flagged license plate, the display alerts the operator promptly. Additionally, operators can review past footage and check the system's status using the LCD display. In simple terms, LCD display helps operators stay informed and ensure the system operates smoothly.

CAMERA:

Using phone camera to capture number plates in vehicle number plate detection offers a straightforward and accessible solution. With smartphone being equipped with camera, operators can easily take clear pictures of passing vehicles' number plates. This eliminates the need for specialized equipment and makes the process cost-effective. Smartphone camera often has advanced features like high-resolution sensors, ensuring clear and detailed images. Operators can simply point their phones at passing vehicles, take a photo of the number plate, and submit it to the detection system. This simple process allows operators to contribute efficiently to the detection process using readily available technology. Overall, using phone camera for number plate capture in vehicle detection is a practical and convenient approach.

The Pi Camera is a high-quality camera module designed for the Raspberry Pi, featuring resolutions up to 12.3MP. It connects via the Camera Serial Interface (CSI) port, ensuring efficient data transfer. Capable of capturing clear, high-definition images and videos, it supports adjustable settings like exposure, white balance, and ISO, making it versatile for various lighting conditions. Its compact and lightweight design is ideal for space-constrained projects. In a vehicle number plate detection project, the Pi Camera captures real-time images, which are processed using computer vision and machine learning algorithms on the Raspberry Pi to accurately detect and recognize number plates. This setup enables efficient and automated number plate recognition for applications such as automated toll collection, parking management, and security systems.



ADAPTER:

In vehicle number plate detection, a 5V 2A adapter is like the system's power lifeline. It's a device that plugs into a power outlet or vehicle socket and provides a steady flow of electricity. This electricity powers up all the important parts of the system, like cameras, processors, and sensors, so they can do their jobs properly. Without the adapter, the system wouldn't be able to capture images, process data, or transmit information. So, in simple terms, the 5V 2A adapter keeps the whole detection system running smoothly by giving it the energy it needs.

CHAPTER-6

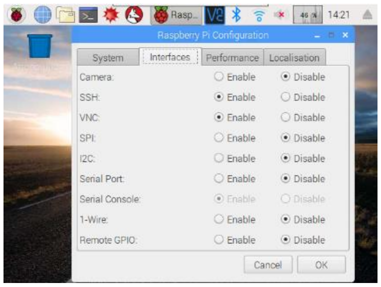
SOFTWARE DESCRIPTION

RASPBERRY PI OPERATING SYSTEM:

Using Raspberry Pi OS for vehicle number plate detection offers a reliable and efficient solution. Compatible with Raspberry Pi single-board computers, this operating system is optimized for the hardware, ensuring smooth performance. Raspberry Pi OS supports camera modules, allowing easy integration for capturing vehicle images. It comes with pre-installed programming tools like Python and OpenCV, essential for implementing detection algorithms. Moreover, its support for remote access enables convenient monitoring and management of the detection system. Customizable and backed by a supportive community, Raspberry Pi OS provides a versatile platform for building and deploying vehicle number plate detection systems.

REALVNC VIEWER:

RealVNC Viewer serves as a practical tool for remotely accessing and managing vehicle number plate detection systems. With its user-friendly interface and straightforward setup, RealVNC Viewer enables operators to monitor and control the detection system from any location with internet access. By remotely connecting to the Raspberry Pi or other computing devices running the detection software, operators can view live camera feeds, review detection results, and adjust system settings in real-time. This remote access capability enhances system flexibility and convenience, allowing operators to respond promptly to events and monitor system performance without being physically present at the detection site. RealVNC Viewer thus plays a crucial role in facilitating efficient and effective operation of vehicle number plate detection systems by providing seamless remote access and management capabilities.

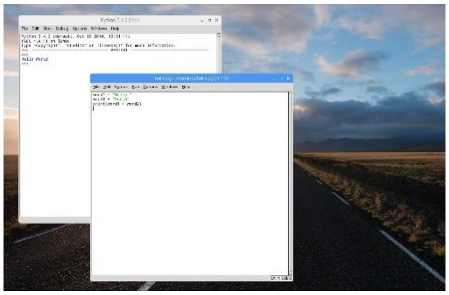


Raspberry Pi Configuration

Camera: ○ Enable ● Disable
SSH: ● Enable ○ Disable
VNC: ● Enable ○ Disable
SPI: ○ Enable ● Disable
I2C: ○ Enable ● Disable
Serial Port: ○ Enable ● Disable
Serial Console: ● Enable ○ Disable
1-Wire: ○ Enable ● Disable
Remote GPIO: ○ Enable ● Disable

PYTHON 3 IDLE:

Python 3 IDLE serves as a convenient and accessible development environment for implementing vehicle number plate detection algorithms. As an integrated development environment (IDE) for Python programming language, Python 3 IDLE offers a user-friendly interface and a range of features tailored for coding and testing Python scripts. Moreover, Python's extensive library ecosystem, including libraries such as OpenCV for image processing and TensorFlow for machine learning, can be easily utilized within Python 3 IDLE to develop sophisticated detection algorithms. Overall, Python 3 IDLE serves as a versatile tool for developing and testing vehicle number plate detection algorithms, empowering developers to create effective solutions for this task.



File Edit Shell Debug Options Windows Help
File Edit Format Run Options Windows Help

```
Python 3.4.2 (default, Oct 19 2014, 13:31:11)
[GCC 4.9.1] on linux
Type "copyright", "credits" or "license()" for more information.
>>> ============================ RESTART ============================
>>>
Hello World
>>>
```

```
word1 = "Hello "
word2 = "World"
print(word1 + word2)
```

CHAPTER-7

CONCLUSION

In conclusion, number plate detection stands as a pivotal technology with diverse applications ranging from law enforcement to automated toll collection and parking management. By leveraging advancements in computer vision, image processing, and machine learning, modern number plate detection systems offer robust and efficient solutions for accurately identifying vehicle number plates in various environments. These systems play a crucial role in enhancing traffic management, improving security, and streamlining administrative processes.

The successful implementation of number plate detection systems relies on a combination of sophisticated algorithms, reliable hardware, and user-friendly interfaces. Through careful integration, testing, and optimization, these systems can achieve high levels of accuracy and performance, meeting the demands of real-world scenarios.

Furthermore, ongoing maintenance and updates are essential to ensure the continued reliability and effectiveness of number plate detection systems. Regular monitoring, software updates, and hardware inspections help to address any issues promptly and keep the system up-to-date with evolving requirements and technological advancements.

Overall, number plate detection represents a significant advancement in the field of transportation and surveillance, offering a valuable tool for improving safety, efficiency, and convenience in various domains of modern society. As technology continues to evolve, the potential for further innovation and refinement in number plate detection systems remains promising, paving the way for a future of enhanced mobility and security.

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