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Traffic Rules Violation Detection System

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Abstract:- This paper represents design and implementation of Traffic Rules Violation Detection System. The traffic rules violation detection system is an advanced technology that can identify and analyze traffic violations using computer vision techniques. The system uses cameras installed at traffic junctions to capture images and videos of vehicles violating traffic rules. These images and videos are then processed using artificial intelligence algorithms to detect and classify the type of violation, such as jumping a red light, over- speeding, or lane violation. The system can also generate automated alerts and notifications to law enforcement agencies to take action against the violators. The system helps in reducing the number of accidents and improving overall road safety by enforcing traffic rules and regulations.

***Keywords*:-** *Python,OpenCV, Image Processing.*

I. INTRODUCTION

The traffic rules violation detection system is an advanced technology that has been developed to improve road safety by enforcing traffic rules and regulations. The system uses computer vision techniques to capture images and videos of vehicles violating traffic rules, such as over-speeding, jumping red lights, or lane violations. The system is equipped with artificial intelligence algorithms that can detect and classify the type of violation and generate automated alerts and notifications to law enforcement agencies.

The need for such a system arises from the increasing number of accidents and fatalities caused by reckless driving and violation of traffic rules. According to the World Health Organization, road accidents are the eighth leading cause of death globally, with approximately 1.35 million people losing their lives every year. In addition to the human cost, road accidents also result in significant economic losses due to damage to vehicles and infrastructure.

To address these issues, governments and law enforcement agencies have been implementing various measures, including stricter traffic laws and increased enforcement. The traffic rules violation detection system is a technological solution that can complement these efforts by providing an automated and efficient method of detecting and reporting traffic violations.

Traffic rules violation detection systems is promising system, as new advancements in technology and artificial intelligence continue to be developed.

II. LITERATURE SURVEY

1. "A Survey of Intelligent Traffic Systems" by S. Pandey and S. K. Singh (2021)provides a comprehensive survey of intelligent traffic systems, including traffic violation detection systems. The authors discuss the various types of traffic violations, the challenges in detecting and classifying them, and the techniques used for object detection and classification. They also highlight the limitations of current systems and suggest areas for further research, such as the use of multimodal data and the integration of real-time data sources.[7]"An Overview of Traffic Violation Detection and Monitoring Systems" by S. Ghose, S. Sarkar, and S. Das (2021) provides an overview of traffic violation detection and monitoring systems and discusses the various techniques used for object detection and classification. The authors also discuss the challenges in implementing such systems, such as the need for accurate data and the difficulty in detecting violations in complex traffic situations. They suggest the need for continued research in this field to improve the accuracy and efficiency of traffic violation detection systems. [8] "Real-Time Traffic Rule Violation Detection and Alert System using Deep Learning" by R. Gupta and P. Anand (2020)proposes a real-time traffic rule violation detection and alert system using deep learning techniques. The authors use a YOLOv3 algorithm for object detection and classification and an LSTM network for real-time alert generation. The paper also discusses the experimental results and highlights the system's accuracy and efficiency.[9] "Traffic Rule Violation Detection System using Deep Learning Techniques" by R. Jain and V. Jain (2019)proposes a traffic rule violation detection system based on deep learning techniques. The authors use a YOLOv3 algorithm for object detection and classification and an SVM classifier for traffic rule violation detection. The paper also discusses the experimental results and highlights the system's accuracy and efficiency. [10]

Overall, these papers provide a detailed overview of traffic violation detection systems, highlighting the challenges and limitations of current systems and suggesting areas for further research. They also propose novel techniques for object detection and classification and demonstrate the effectiveness of deep learning techniques in improving the accuracy and efficiency of traffic violation detection systems.

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III. SYSTEM MODEL

A. Activity Diagram

The Activity diagram is another important behavioral diagram in UML diagram to describe dynamic aspects of the system. They describe how the activities are coordinated to provide a service which can be at different levels of abstraction.

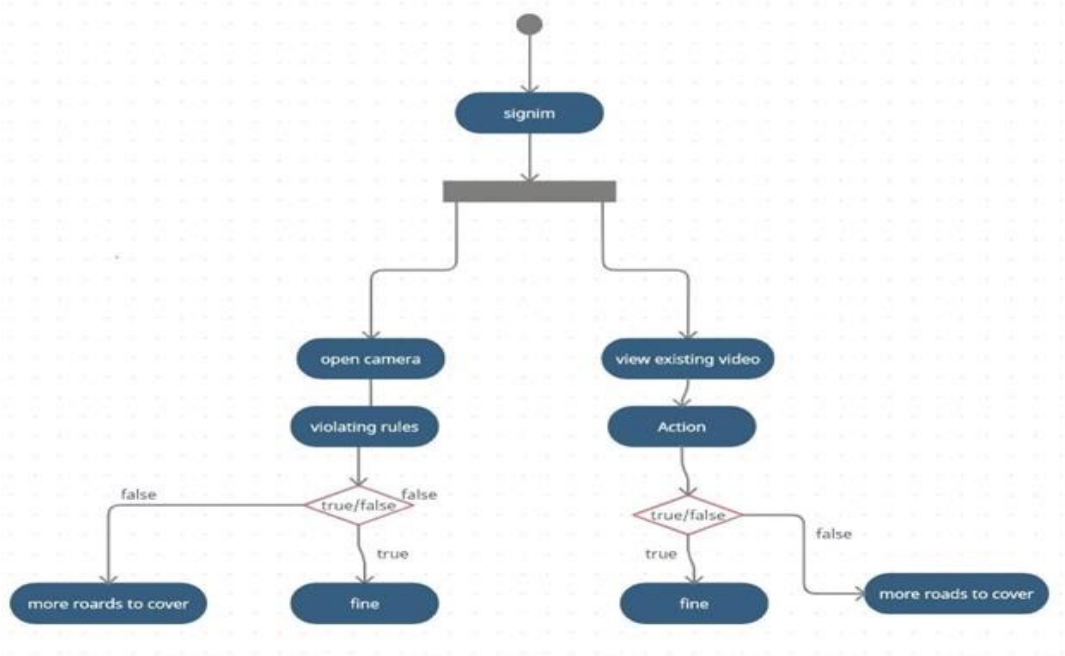

Fig. 1: Activity Diagram of the system

B. Flowchart Of System:

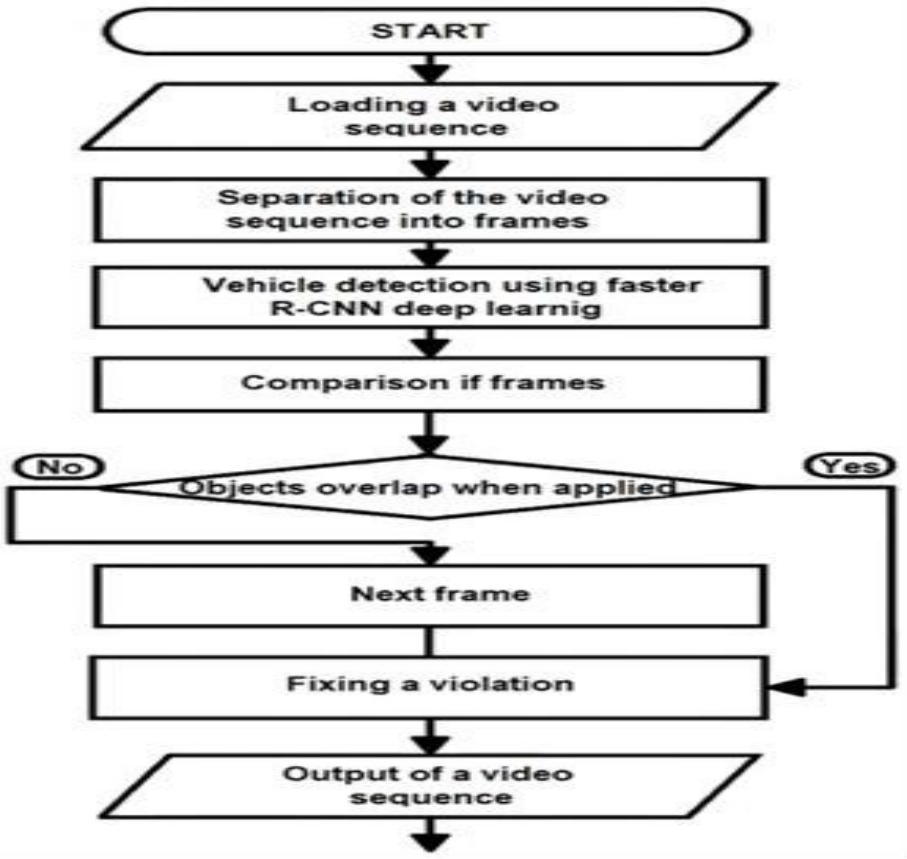

Fig. 2: Flowchart Of System

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C. FUNCTIONAL MODELLING:

With the aid of DFDs (Data Flow Diagram), we will define the function of the internal processes of the system. This perspective concentrates on describing the dynamic process of our deepfake detection system.

➢ *LEVEL 0:*

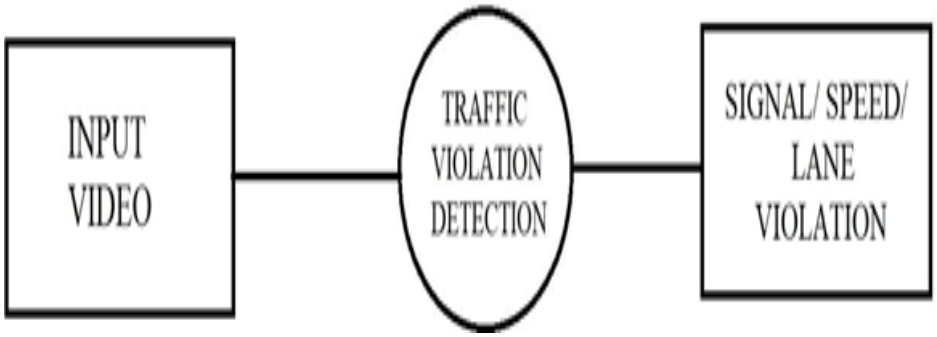

Fig. 3: Level 0 Data Flow Diagram

The "Context level" DFD is the basic overview of the whole system. The user uploads the video, based on which, our system accordingly processes and gives the output to the user. If found to be deepfake, the video is saved to our system.

➢ *LEVEL 1:*

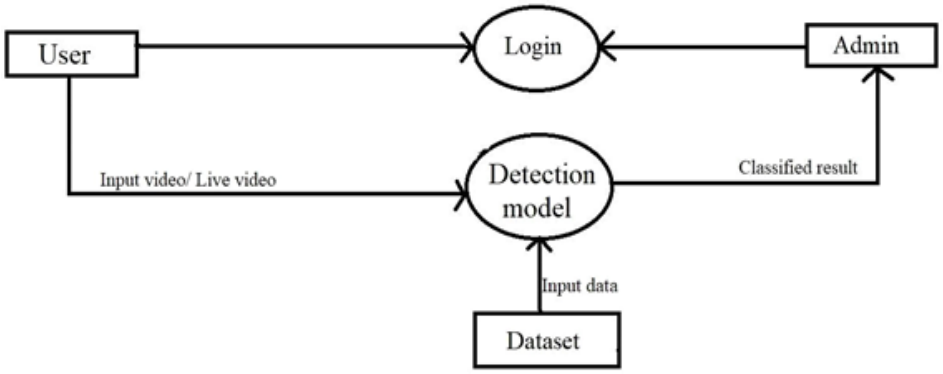

Fig. 4: Level 1 Data Flow Diagram

The Context diagram is decomposed into multiple processes. The main functions of the system are highlighted, where the high-level processes are broken down into subprocesses.

➢ *LEVEL 2:*

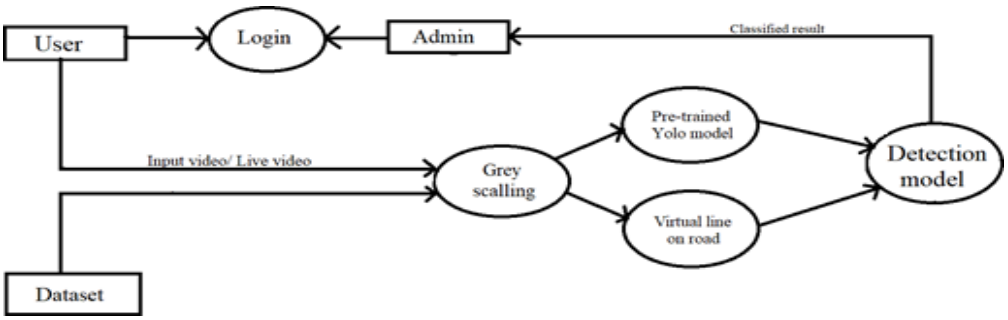

Fig. 5: Level 2 Data Flow Diagram

The level 2 DFD offers a more detailed look at the processes that make up an information system. The diagram defines all the processes and subprocesses of the system through which the user gets the required output.

In short, the user requests the validation of an image/video, which is then processed by the system where each video is checked frame by frame. If found to be genuine, the results are displayed to the user. If found fake, the video is added to the central database with a "Deep Fake" watermark which is then shared to the user to download or share it to others.

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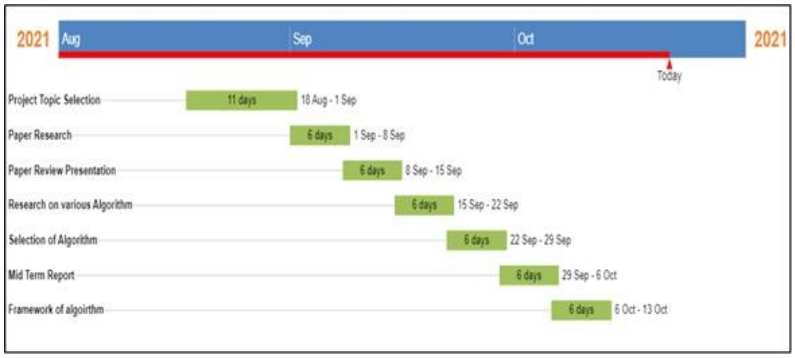
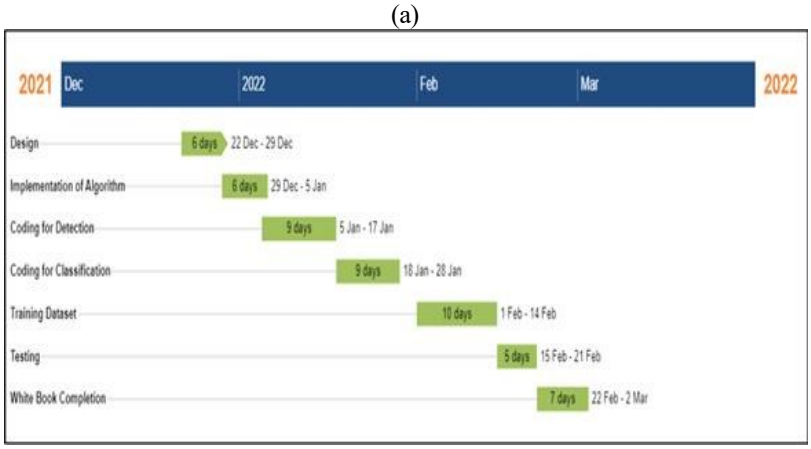
D. TIMELINE CHART:



(a)



(b)

Fig. 6: Timeline chart of our Project

E. ARCHITECTURAL DESIGN

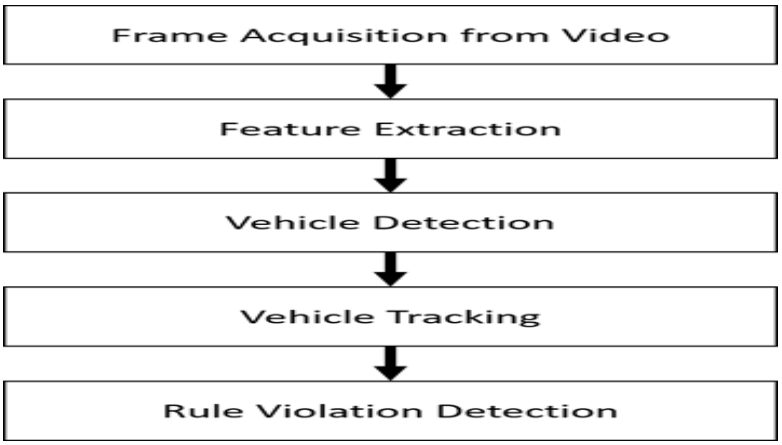


Fig. 7: Architectural Design

With the help of the user interface of our application, users can upload their videos to the system which will then classify it as genuine or Deepfake.Along with that the system will flag the frames that have been altered and label the video as fake on the whole.

If given the proper permissions to upload the video to the central database, other users can also download the same video.

Hence, all flagged fake videos are available for public access, where visitors can also view recent or frequent/popular classified Deep Fakes on the website and leave their feedback.

The classification system will also be available through the system's API enabling offsite users to implement this tool in their application/system the way they want, for which the result will be sent back to the system.

For our deep learning model, the system takes the uploaded input from the user which is then passed on to our trained model. The results are again classified into real and fake videos, which are then passed on to the user.

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The objective in flagging and marking the video, making it available for download is an effort to spread the classified video among networks and popularize it just the way Deep Fakes are spread and popularized so there is a crackdown on it's misuse and malpractice.

IV. IMPLEMENTATIONS

A. Algorithms with implementations:

- **Image Preprocessing**: The first step is to convert the colored image into grayscale. This is done to reduce the complexity of the image and make it easier to detect edges using the Canny edge detection algorithm. The grayscale image is then filtered using a Gaussian filter to reduce noise.
- **Edge Detection**: The Canny edge detection algorithm is then used to identify the edges of the image. The Canny algorithm works by identifying the areas of the image where there is a sharp change in brightness, indicating an edge. This algorithm produces a binary image where the edges are represented as white pixels and the non-edges as black pixels.
- **Line Detection**: Once the edges have been detected, the Hough transform is used to identify the lines in the image. The Hough transform works by converting the binary image into a parameter space where each point represents a line in the original image. The lines are identified by finding the peaks in the parameter space.
- **Rule Violation Detection**: Once the lines have been detected, they can be analyzed to detect traffic rule violations. For example, if the image is of a road and the lines represent the lane markings, the distance between the lines can be analyzed to detect if a vehicle is driving outside its lane.

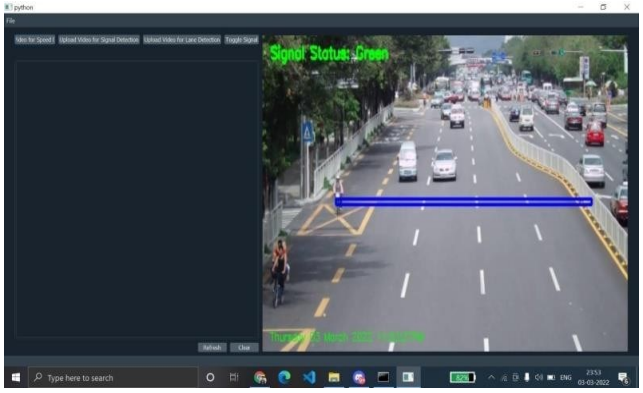

Fig. 8: Edge Detection

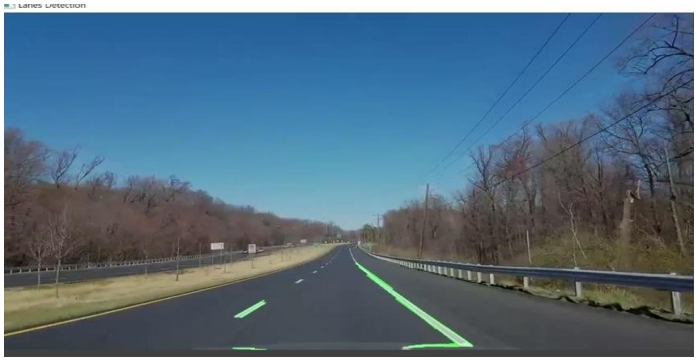

Fig. 9: Line Detection

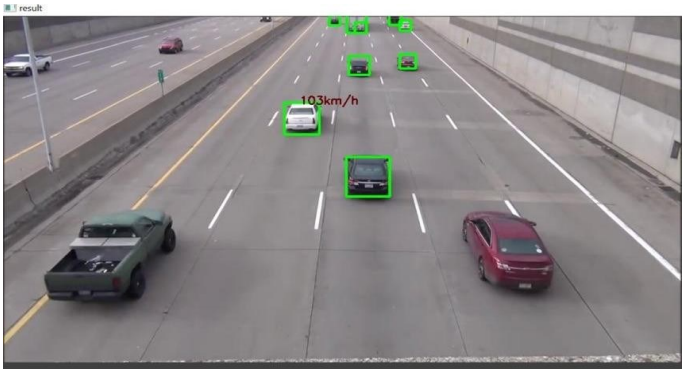

Fig. 10: Rule Violation Dection

V. FUTURE SCOPE

The future scope of traffic rules violation detection systems is promising, as new advancements in technology and artificial intelligence continue to be developed. Some potential areas of growth and improvement include:

- **Integration with Autonomous Vehicles:** As autonomous vehicles become more common on roads, traffic rules violation detection systems could be integrated with these vehicles to ensure that they adhere to traffic rules and regulations.
- **Real-time Monitoring:** The development of faster and more efficient data processing techniques could enable real-time monitoring of traffic violations, allowing for quicker enforcement and response times.
- **Improved Accuracy:** The use of more advanced algorithms and machine learning models could lead to improved accuracy in detecting and classifying different types of traffic violations.
- **Enhanced Data Analytics:** The data collected by traffic rules violation detection systems can be used to analyze traffic patterns and identify areas of high traffic violation rates. This information can then be used to develop more effective traffic management strategies.
- **Expansion to New Regions:** Traffic rules violation detection systems can be implemented in new regions to improve road safety and reduce the number of accidents caused by reckless driving.
- **Integration with Smart City Initiatives:** The integration of traffic rules violation detection systems with other smart city initiatives, such as smart traffic management systems and public transportation systems, can lead to a more efficient and sustainable transportation system.

Overall, the future scope of traffic rules violation detection systems is promising, and continued advancements in technology and artificial intelligence are likely to lead to even more effective and efficient systems in the years to come. The ESP32-CAM is a cost-effective development board based on the ESP32 microcontroller, featuring an onboard camera and compact size. Designed for IoT applications, prototype constructions, and DIY projects, this board integrates Wi-Fi, traditional Bluetooth, and low-power BLE, powered by two high-performance 32-bit LX6 CPUs.

VI. RESULTS AND ANALYSIS

Firstly, for beginning the project, the user requires to open a video using “Open” option that is visible under file. The user can open any footage from the system storage. After opening it, the system will load a preview. It contains one of the frames of the input video. It is used to recognize the roads and select region of interest. The selection by the user will act as a traffic line. To draw this line, we need to click on “Region of interest” item from the Analyze option. After clicking on it, the user needs to pick two points to plot a line that indicates the traffic signal. Selection of the traffic line will automate the process of violation detection. Now the system identifies the vehicles and then it is ready to detect the violations. After that, GUI gives output frame by frame. The system continues to display the result until it reaches the final frame of the video footage. In the background, an output file will be generated. This file can be found in output folder of Resources. This process of violation detection will be terminated. After applying the process to all the frames of the input video footage, the user can give another video as input.If the work is completed the user can quit using Exit item available in the File option.

VII. CONCLUSION

A traffic rules violation detection system is an advanced technology that has the potential to significantly improve road safety and traffic management. By using a combination of cameras, computer vision algorithms, and machine learning models, the system can detect and classify various types of traffic violations, such as running red lights, speeding, and illegal parking. The system can also generate automated alerts and notifications for law enforcement agencies, allowing for quicker enforcement and response times.

Implementing a traffic rules violation detection system can lead to reduced accidents, improved compliance with traffic rules and regulations, increased efficiency, better data collection, and improved public safety. The future scope of such systems is also promising, with potential integration with autonomous vehicles, real-time monitoring, and enhanced accuracy in detecting and classifying traffic violations.

Overall, a traffic rules violation detection system is a valuable tool for improving road safety and traffic management, and its continued development and implementation can lead to significant positive impacts on communities and society as a whole.

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