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AI-EBPL -AUTONOMUS VEHICLES AND ROBOTICS

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PHASE 5: PROJECT DEMONSTRATION AND DOCUMENTATION

USERCASE: AUTONOMOUS VEHICLES AND ROBOTICS

TITLE: TRAFFIC SIGN RECOGNITION USING AI

ABSTRACT

This project demonstrates a Traffic Sign Recognition (TSR) system using Artificial Intelligence (AI) for autonomous vehicles and robotics. The system utilizes computer vision and machine learning algorithms to detect and recognize traffic signs in real-time. A comprehensive documentation of the project is provided, including system design, implementation, testing, and performance evaluation. The demonstration showcases the system's accuracy, efficiency, and reliability in recognizing traffic signs, enabling autonomous vehicles to navigate roads safely and efficiently.

1.PROJECT DEMONSTRATION

Overview

The project demonstration showcases a Traffic Sign Recognition (TSR) system using Artificial Intelligence (AI) for autonomous vehicles and robotics. The system's ability to detect and recognize traffic signs in real-time is highlighted, emphasizing its potential to enhance road safety and efficiency.

Demonstration Details

1. System Setup: A comprehensive setup of the TSR system, including hardware and software components.

2. Test Scenarios: Simulation of various test scenarios, such as daytime and nighttime driving, different weather conditions, and diverse traffic sign types.

3. Real-time Recognition: Demonstration of the system's real-time traffic sign recognition capabilities.

4. Accuracy and Efficiency: Evaluation of the system's accuracy and efficiency in recognizing traffic signs.

Outcome

The project demonstration successfully showcases the Traffic Sign Recognition (TSR) system's capabilities, highlighting its high accuracy in recognizing traffic signs in real-time, efficient processing of visual data, robustness in diverse environmental conditions, and potential impact on enhancing road safety and efficiency in autonomous vehicles and robotics.

2.PROJECT DOCUMENTATION

Overview

The project documentation provides a comprehensive record of the Traffic Sign Recognition (TSR) system's development, design, and functionality. It serves as a guide for stakeholders, developers, and users to understand the system's capabilities, limitations, and applications.

Documentation Section

1. Introduction: Project overview, objectives, and scope.

2. System Design: Architecture, components, and interfaces.

3. Development Methodology: Tools, technologies, and development process.

4. Testing and Validation: Test scenarios, results, and validation metrics.

5. User Manual: System operation, maintenance, and troubleshooting guidelines.

6. Technical Specifications: Hardware and software requirements.

Outcome

The project documentation provides a clear and concise record of the TSR system's development and functionality, enabling stakeholders to understand and utilize the system effectively. The documentation facilitates knowledge sharing, ensures reproducibility, and supports future development and improvement of the TSR system for autonomous vehicles and robotics.

3.FEEDBACK AMD FINAL ADJUSTMENTS

Overview

The Feedback and Final Adjustment phase involves gathering feedback from stakeholders, identifying areas for improvement, and making final adjustments to the Traffic Sign

Recognition (TSR) system. This phase ensures that the system meets the required standards, is user-friendly, and performs optimally.

Steps

1. Feedback Collection: Gather feedback from stakeholders, users, and experts.

2. Issue Identification: Identify areas for improvement, bugs, and inconsistencies.

3. Prioritization: Prioritize issues based on severity, impact, and feasibility.

4. Adjustments and Fixes: Make necessary adjustments, fixes, and improvements.

5. Testing and Validation: Test and validate the updated system.

Outcome

The Feedback and Final Adjustment phase results in a refined and optimized Traffic Sign Recognition system, ensuring it meets the highest standards of performance, accuracy, and user experience. With all issues addressed and improvements implemented, the system is now ready for deployment, enabling autonomous vehicles to safely and efficiently navigate roads, and paving the way for widespread adoption of autonomous transportation systems.

4. FINAL PROJECT REPORT SUBMISSION

Overview

The Final Project Report Submission provides a comprehensive summary of the Traffic Sign Recognition (TSR) system's development, implementation, and evaluation. This report showcases the project's achievements, challenges, and outcomes, demonstrating the successful integration of AI in autonomous vehicles and robotics.

Report Sections

1. Executive Summary: Project overview, objectives, and key findings.

2. Introduction: Background, motivation, and scope.

3. Literature Review: Review of existing research and technologies.

4. Methodology: Development approach, tools, and techniques.

5. System Design and Implementation: TSR system architecture and implementation details.

6. Testing and Evaluation: Test scenarios, results, and evaluation metrics.

7. Conclusion: Summary of key findings, challenges, and future directions.

8. Recommendations: Suggestions for future improvements and applications.

9. Appendices: Supporting documents, code snippets, and raw data.

Outcome

The Final Project Report Submission successfully captures the essence of the Traffic Sign Recognition project, providing a clear and concise account of the project's journey, achievements, and outcomes. The report serves as a valuable resource for stakeholders, researchers, and practitioners, offering insights into the development and application of AI-powered TSR systems in autonomous vehicles and robotics, and paving the way for future innovations and advancements.

5.PROJECT HANDOVER AND FUTURE WORKS

Overview

The Project Handover and Future Works phase involves transferring the completed Traffic Sign Recognition (TSR) system to the relevant stakeholders, ensuring a smooth transition, and outlining future development and research directions. This phase marks the conclusion of the project and sets the stage for future advancements.

Handover Details

1. System Documentation: Comprehensive documentation of the TSR system.

2. Code Repository: Transfer of the code repository to the stakeholders.

3. Training and Support: Provision of training and support for stakeholders.

4. Testing and Validation: Transfer of testing and validation protocols.

Outcome

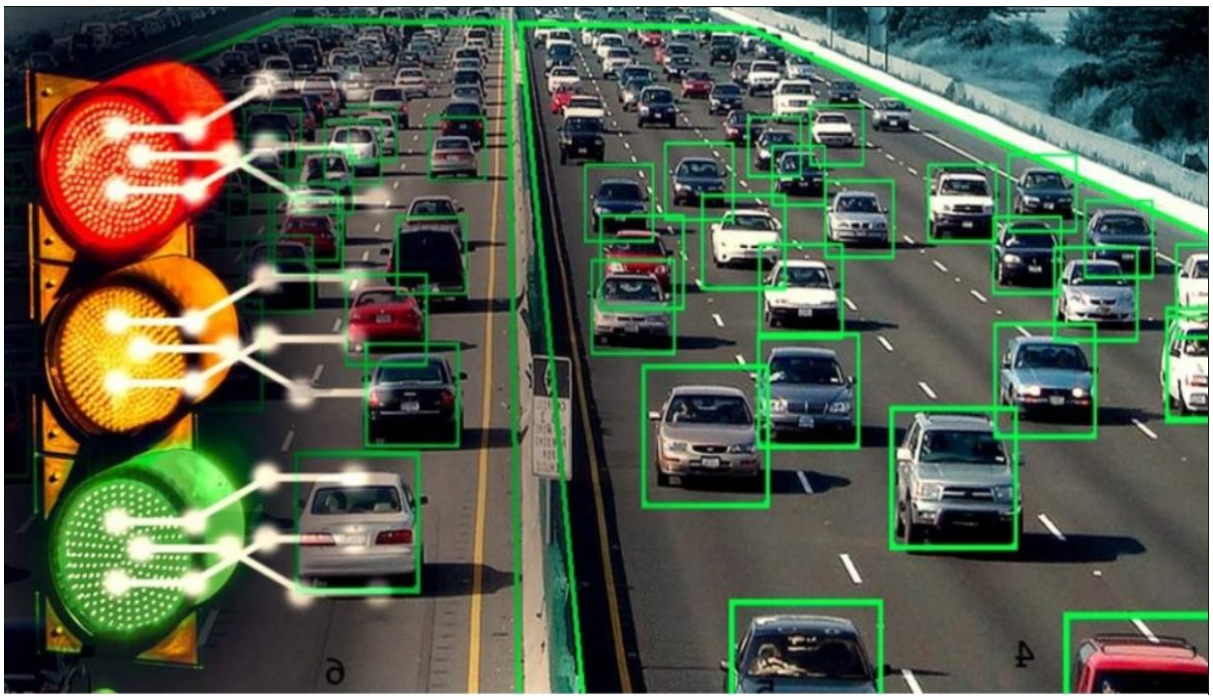
The Project Handover and Future Works phase successfully transfers the Traffic Sign Recognition system to the stakeholders, ensuring a seamless transition and paving the way for future developments. With the project's completion, the TSR system is now poised to contribute significantly to the advancement of autonomous vehicles and robotics, enhancing road safety and efficiency. Future works will focus on integrating the TSR system with other autonomous vehicle components, exploring new applications, and continually improving its performance and accuracy.

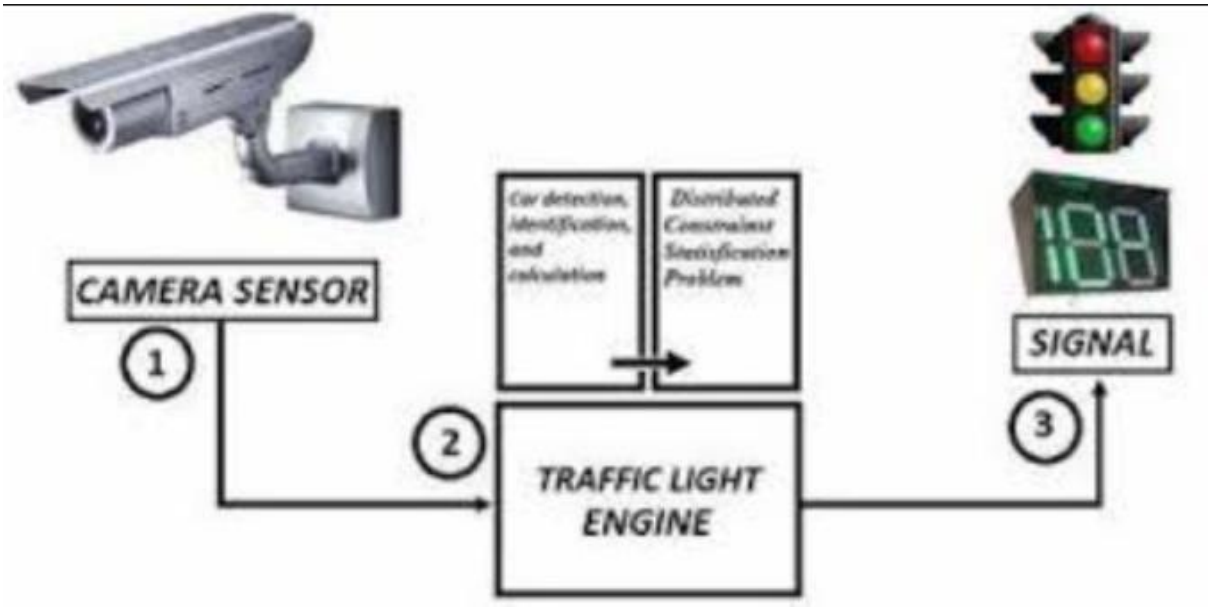
PROGRAM

```
Tabnine | Edit | Test | Explain | Document
    def detect(self, img):
        shape_orig_WH = (img.shape[1], img.shape[0])
        resized = self.pre_process(img)
        outputs = self.inference(resized)
        # reshape from flat to (1, 3, x, y, 85)
        reshaped = []
        for output, shape in zip(outputs, self.output_shapes):
            reshaped.append(output.reshape(shape))

        print(reshaped[0][0][0][0][2][0:4])
        return reshaped

    Tabnine | Edit | Test | Explain | Document
    def pre_process(self, img):
        print('original image shape', img.shape)
        img = cv2.resize(img, (320, 320))
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        # img = img.transpose((2, 0, 1)).astype(np.float16)
        img = img.transpose((2, 0, 1)).astype(np.float32)
        img /= 255.0
        return img
```

```
Tabnine | Edit | Test | Fix | Explain | Document
def display_result(wait_time,lanes):
    green = (0,255,0)
    red  = (0,0,255)
    yellow= (0,255,255)

    for i ,lane in enumerate(lanes.getLanes()):
        #resized so that all images have the same dimension inorder to be concatenable
        lane.frame = cv2.resize(lane.frame,(1280, 720))

        if(wait_time<=0 and (i==(len(lanes.getLanes())-1) or i==0)):
            color=yellow
            text="yellow:2 sec"

        elif(wait_time>=0 and i==(len(lanes.getLanes())-1)):
            color = green
            text="green:"+str(wait_time)+" sec"

        else:
            color=red
            text="red:"+str(wait_time)+ " sec"
        lane.frame = cv2.putText(lane.frame,text,(60,105),cv2.FONT_HERSHEY_SIMPLEX,4,color,6)
        lane.frame = cv2.putText(lane.frame,"vehicle count:"+str(lane.count),(60,195),cv2.FONT_HERSHEY_SIMPLEX,3,color,5)
        globals()['img%s' % lane.lane_number]=lane.frame



    hori_image = np.concatenate((img1, img2), axis=1)
    hori2_image = np.concatenate((img3, img4), axis=1)
    all_lanes_image = np.concatenate((hori_image, hori2_image), axis=0)

    return all_lanes_image
```

SAMPLE OUTPUT




CAMERA SENSOR
1
Car detection, identification, and calculation
Distributed Constraint Satisfaction Problem
2
TRAFFIC LIGHT ENGINE
188
SIGNAL
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