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Next-Gen Travel Safety for Women: Integrating Advanced Technologies for Enhanced Security

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Abstract- Next-Gen Travel Safety for Women: Integrating Advanced Technologies for Enhanced Security Abstract Ensuring safe travel on roads with automobiles or cabs is crucial for creating secure urban environments. Women traveling face significant risks, including harassment, unwanted physical touch, kidnapping, and assault. Often, the shortest or fastest route is not necessarily the safest. Users may prefer a slightly longer route if it means avoiding these dangers. Current navigation systems like Google Maps, Apple Maps, and Bing Maps fall short in addressing safety concerns such as theft, eve-teasing, snatching, hijacking, robbery, and more. These systems typically overlook safety factors in route planning. With rising urban crime rates, addressing safety and security for women has become a pressing concern. To tackle this challenge, this project introduces an innovative Travelers Safety Solution, utilizing advanced technologies to enhance the safety and experience of women commuters. By integrating Google Maps API, YOLOv8 for object detection, Tesseract OCR for text recognition, and connectivity with RTO servers, the system offers a comprehensive safety framework. Key features include route planning based on real-time traffic data, driver communication, SMS notifications with critical journey details, and real-time location tracking. The system actively monitors route deviations using map-matching algorithms, triggering immediate emergency alerts if deviations occur, notifying both the user and their emergency contacts. Additionally, users can review and provide feedback on driver performance post-journey. This solution not only addresses the safety concerns of women travelers but also empowers them with real-time information and communication, fostering a safer and more secure commuting experience.

1. INTRODUCTION

Auto rickshaws and taxis are two essential modes of transportation in urban areas, each catering to the transportation needs of passengers, offering flexible, accessible, and personalized travel solutions. Auto rickshaws are compact, three-wheeled vehicles commonly found in many cities and towns, especially in regions where traffic congestion and narrow roads make other forms of transport impractical. An auto-rickshaw typically accommodates 2-3 passengers and is powered by a small engine. It operates primarily in shorter distances and urban localities, providing an affordable, convenient, and accessible alternative to private car ownership and public

transportation. Auto rickshaws are often available for hire on demand, and passengers can either negotiate a fare directly with the driver or use an electronic meter to calculate the cost of their journey. They are particularly helpful in navigating densely populated areas, as their small size allows them to weave through traffic and reach destinations that may be inaccessible to larger vehicles. Auto rickshaws are especially popular in regions where short trips are frequent and public transportation options are limited. Taxis, in contrast, are four-wheeled vehicles designed for carrying passengers to various destinations, offering a higher level of comfort and convenience compared to auto rickshaws. Taxis are available for hire through various channels, including street hailing, phone bookings, or ride-hailing apps. Taxis generally have a fixed rate or metered pricing depending on the distance and time taken for the journey. Unlike auto rickshaws, taxis can accommodate more passengers, often up to four, making them suitable for families, business travelers, or those with luggage. Taxis are used for both short- and long-distance travel, making them versatile for a variety of trip purposes. They offer more privacy and security for passengers, making them an ideal choice for late-night travel, airport transfers, or trips requiring a higher degree of comfort and safety. The primary purpose of auto rickshaws and taxis is to offer flexible, on-demand transportation. These vehicles are crucial in urban and suburban areas, particularly in places where public transportation options may not be easily accessible or reliable. Auto rickshaws provide a quick and affordable way to travel short distances, often serving areas not well-served by buses or trains. They cater to people who need a fast, inexpensive solution for local travel, whether for commuting, errands, or casual travel. On the other hand, taxis serve a broader spectrum of users by offering greater comfort and the ability to travel longer distances. Taxis are favored by passengers who prioritize convenience, security, and privacy, such as tourists, business travelers, or individuals requiring a more comfortable journey for long trips. They are also widely used for special events and airport transfers, where comfort and timeliness are crucial. Both auto rickshaws and taxis play an integral role in the transportation ecosystem, especially in regions with high population density and limited public transportation infrastructure. They provide door-to-door services, ensuring that people can reach their destinations directly and without the hassle of navigating public transport systems. These modes of transportation are vital for economic growth, as they ensure mobility for workers, tourists, and others, enabling people to access jobs, services, and leisure activities efficiently. In cities with fluctuating traffic patterns, the flexibility and convenience of auto rickshaws and taxis make them an indispensable solution to address transportation challenges. Both auto rickshaws and taxis are critical in providing affordable, safe, and reliable transportation options for people, especially in cities where public transport may not be sufficient or flexible. They address the need for personalized travel, offering immediate access to a convenient mode of transport at any time.

2. PROPOSED SYSTEM

The proposed system is developing to enhance the safety of women travelers

by integrating advanced technologies. This system uses Google Maps API, YOLOv8 for object detection, Tesseract OCR for text recognition, and real-time connectivity with RTO servers to ensure safety and driver verification. Key features include route planning based on real-time traffic data, secure communication with the driver, and automated SMS notifications sent to emergency contacts with journey details. Additionally, the system tracks the user's location and any route deviations, triggering immediate alerts in case of any anomaly. The solution empowers users by providing continuous monitoring, feedback options, and real-time communication, creating a safer and more secure commuting experience for women.

The core of this system includes:

- **Route Planning and Optimization**: The system uses Google Maps API to plan routes based on real-time traffic data. Users can choose safer routes, which may not always be the shortest but avoid areas with higher safety risks. This feature allows users to prioritize safety over speed.
- **Driver Verification and Safety**: The system integrates YOLOv8 for real-time object detection and Tesseract OCR for license plate recognition, enabling verification of the driver and vehicle through automatic license plate scanning. The RTO server connectivity ensures accurate driver details, offering added security to the user.
- **Real-Time Communication**: The system establishes direct communication with the assigned driver, ensuring the user can always contact them. It also allows for emergency communication in case of unforeseen events.
- **Journey Notification and Alerts**: Once the journey begins, the system sends SMS notifications to the user's emergency contacts, providing essential journey details such as the driver's name, vehicle details, and real-time tracking links. These notifications ensure continuous monitoring and increase the transparency of the journey.
- **Route Deviation Detection**: Using map-matching algorithms, the system monitors any deviations from the planned route. If the user deviates from the selected path, an immediate alert is triggered, notifying both the user and their emergency contacts. This ensures that any unexpected changes in the journey are immediately addressed.

2.2 TECHNIQUE WORKS

1. User Authentication and Registration

Session Management: The code uses Flask sessions to manage user login states and user types (e.g., 'rto', 'user', 'owner').

Password Handling: The code checks user credentials against stored values in the database.

2. File Upload and Handling

File Uploads: The code handles file uploads (e.g., vehicle images)

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using Flask's request.files and saves them securely using werkzeug.utils.secure_filename.

3. Image Processing

OpenCV for Image Processing: The code uses OpenCV to process images for license plate detection. Key steps include:

Grayscale Conversion: Converting the image to grayscale.

gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

Gaussian Blur: Applying Gaussian blur to reduce noise.

blurred = cv2.GaussianBlur(gray, (5, 5), 0)

Edge Detection: Using Canny edge detection to find edges in the image.

edged = cv2.Canny(blurred, 30, 150)

Contour Detection: Finding contours in the edged image to locate the license plate.

contours, _ = cv2.findContours(edged.copy(), cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_S

4. Optical Character Recognition (OCR)

Pytesseract for OCR: The code uses Pytesseract to extract text (license plate numbers) from the processed image.

license_plate = pytesseract.image_to_string(roi, config='--psm 6')

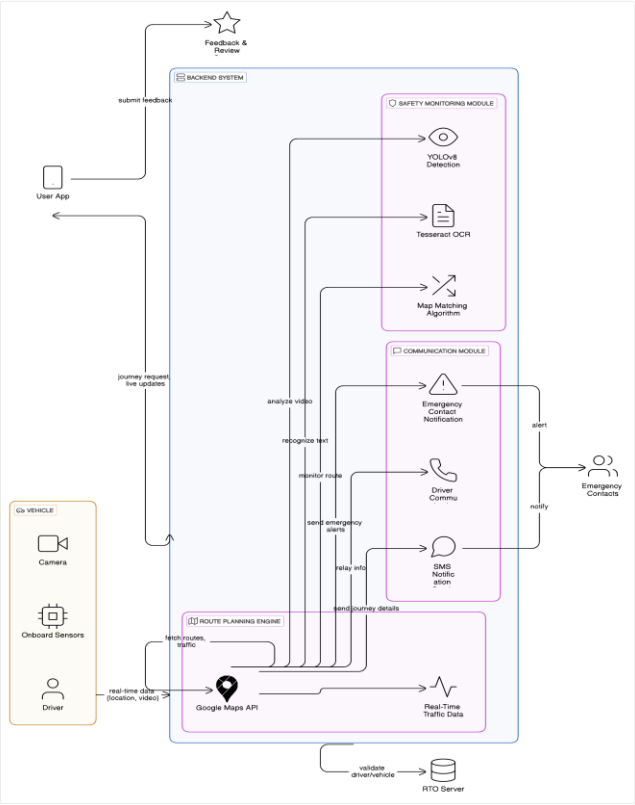

Figure 1: Next-Gen Travel Safety Solution for Women - High-Level Architecture

2.3 ADVANTAGES OF PROPOSED SYSTEM

- Enhanced safety for women travelers.
- Route optimization for safer travel.
- Real-time communication with drivers and emergency contacts.
- Driver verification using advanced technologies.
- Immediate emergency response through route deviation alerts.

- Continuous location sharing for enhanced security.
- User feedback collection for safety improvements.
- Easy-to-use system for seamless interaction.
- Cost-effective and scalable solution.
- Regulatory compliance ensuring privacy and security.
- Increased confidence and empowerment for women travelers.

3. CONCLUSION AND FUTURE ENHANCEMENTS

To further strengthen the impact and scalability of the Next-Gen Travel Safety system, several future enhancements are envisioned. One key area is the integration of AI-powered threat detection that can analyze user behavior, route anomalies, and environmental data to automatically predict and prevent potential risks. Incorporating machine learning algorithms could also improve alert prioritization and system responsiveness over time. Expansion of multi-language support and accessibility features would make the platform more inclusive for users across different regions and with diverse needs. Additionally, integrating public transport APIs can provide real-time transit updates and route suggestions that optimize both safety and convenience. Plans for blockchain-based identity verification could enhance data integrity and trust, particularly in verifying drivers or transport providers. Future versions could also support offline mode functionality , allowing alerts to be queued and automatically sent once connectivity is restored. Lastly, partnerships with local law enforcement and emergency services for direct alert integration would significantly improve response times and user protection. These enhancements aim to evolve the platform into a smarter, more proactive, and globally adaptable safety solution.

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