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Adaptive Driver Vigilance Surveillance System

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Abstract

The integration of physiological indicators and behavioral patterns in adaptive driver vigilance surveillance systems. It evaluates current methodologies, highlights the benefits of a combined approach, and suggests future research directions to enhance driver monitoring and road safety. An Adaptive Driver Vigilance Surveillance System is designed to monitor and assess a driver's alertness in real-time, aiming to enhance road safety by detecting signs of drowsiness or inattention. This system utilizes non-intrusive methods, such as computer vision and physiological sensors, to continuously evaluate the driver's state and provide timely alerts or interventions when necessary. By continuously adapting to the driver's state and providing timely interventions, an Adaptive Driver Vigilance Surveillance System aims to reduce the incidence of accidents caused by driver fatigue or inattention, thereby enhancing overall road safety.

Introduction

The survey helps assess driver fatigue, identify risk factors, evaluate system effectiveness, and gather user feedback to improve the Adaptive Driver Vigilance Surveillance System for enhanced road safety. Driver vigilance is crucial for safe driving. Distraction and fatigue are major causes of accidents. Modern surveillance systems, especially adaptive systems using computer vision and sensor fusion, can address these issues effectively. This paper proposes a low-cost embedded system that detects facial features and behavioral indicators using Raspberry Pi and alert systems.

Driver Vigilance and Safety:
Vigilance is the sustained attention needed to respond to critical stimuli. Approximately 25-30% of road accidents are due to distracted driving, and 20% of fatal crashes involve drowsiness. Monitoring via cameras, EEG, HRV, and behavioral analysis (e.g. Steering patterns) allows proactive accident prevention.

Physiological and Behavioral Monitoring:
-HRV is used to assess stress and fatigue
-EEG tracks brain activity for alertness
-Eye tracking detects blinking and gaze
-Steering patterns and control interaction reveal distraction Fusion of these indicators improves reliability.

System Design And Components:
This system leverages:

-Vision-based analysis through a camera to detect drowsiness.
-Alcohol detection using the MQ3 sensor.
-Steering interaction detection via a micro switch.
-Real-time alerts through buzzer and LED display.

This low-cost yet effective system aims to increase road safety, especially in developing regions where expensive ADAS (Advanced Driver-Assistance Systems) are not feasible.

BLOCK DIAGRAM

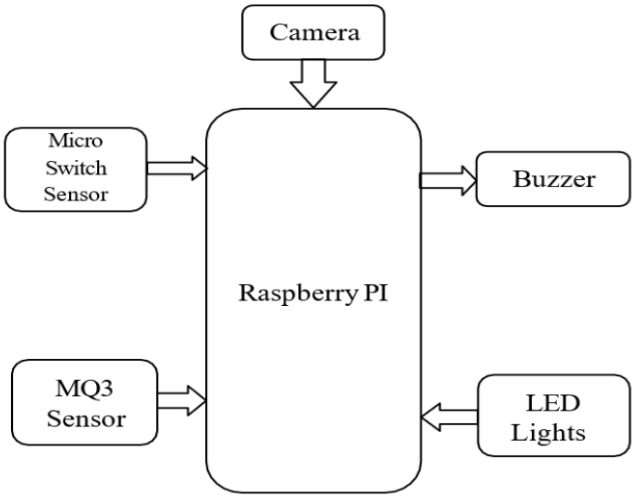

Figure 1. Block Diagram

Each component in the diagram has a unique function:
-Camera: Detects drowsiness using facial landmarks (blinking, yawning).
-Micro Switch Sensor: Detects whether hands are off the wheel.
-MQ3 Sensor: Detects ethanol levels in driver's breath.
-Buzzer and LED Display: Provide audio-visual alerts.
All components are interfaced with Raspberry Pi, which handles input/output logic and processing.

CIRCUIT DIAGRAM

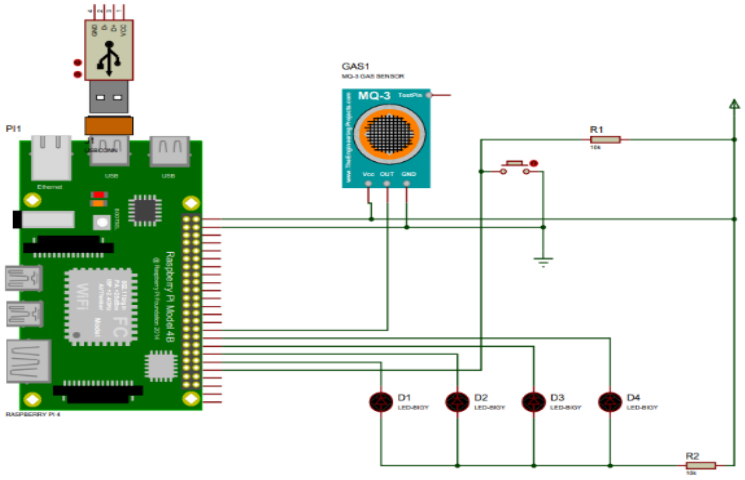

Figure 2. Circuit Diagram

Key observations from the circuit:
-MQ3 Sensor is connected to GPIO through analog signal. If needed, an ADC like MCP3008 is used.
-LEDs (D1-D4) indicate various levels of alert (e.g., yellow for warning, red for danger).
-Push Button acts as manual override or emergency indicator.
-Resistors (R1, R2) ensure stable voltage levels and signal integrity.
This wiring ensures clear data transmission and efficient response times within the system.

SYSTEM WORKING

The primary goal of our project is to save the driver's life and prevent accidents. The working of the project begins with setting up all operations using the Raspberry Pi. All components and functionalities are integrated and controlled through the Raspberry Pi, making it the core processing unit of the system. The project focuses on continuously monitoring the driver's physiological and behavioral patterns to ensure their vigilance while driving.

Raspberry Pi: It's is a type of single board computer that's mean the entire hardware is set is placed on a single electronic board. It has 40 pins are available in raspberry pi. Main working of our project is raspberry Pi. We used the python language for this component to easily helpful our project.

Web Camera: Web camera is a digital camera that capture the video, audio data and transmit to the raspberry Pi over the internet. In this project the camera's working is detect the face because our driver is sleepy mode or not. When the driver is in sleeping when buzzer is turn on and relay also on.

Sensors: We used three sensors in our project to detect, monitored and inform that. So, we used these two sensors is Micro Switch sensor and MQ3 sensor.

Figure 3: System Working

1.VNC Server:

VNC Server is a remote desktop software that allows you to view and control another computer's desktop over a network connection. It operates on the Remote Frame Buffer (RFB) protocol, transmitting keyboard and mouse inputs from one computer to another, and relaying graphical-screen updates back.By default, the RFB protocol used by VNC is not secure. While passwords are not sent in plain text, they can be vulnerable if both the encryption key and encoded password are intercepted. Therefore, it's recommended to use strong passwords and consider tunneling VNC over SSH or VPN for enhanced security.

Key Features:

1)Cross-Platform Compatibility: VNC is platform-independent, with clients and servers available for various operating systems.

2)Remote Access: Enables users to access and manage computers remotely, which is beneficial for monitoring and support tasks.

3)Multiple Implementations: There are several variants of VNC, such as RealVNC, TightVNC, and TigerVNC, each offering unique features.

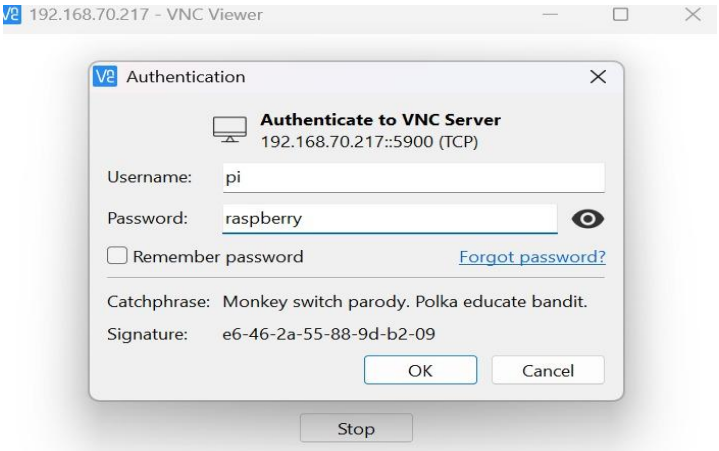

Figure 4: VNC Server

2. Advanced IP Scanner:

Advanced IP Scanner is a free and reliable network scanner designed to analyze LANs. It quickly identifies all network devices, providing access to shared folders, and can even remotely switch computers off.

Key Features:

1)Fast Network Scanning: Scans hundreds of IP addresses simultaneously, providing results in seconds.

2)Remote Control: Integrates with remote control software like Rad min and RDP, allowing for remote management of computers.

3)User-Friendly Interface: Offers an intuitive interface, making it accessible for both professionals and beginners.

4)Portable Version: Can be run without installation, which is convenient for on-the-go network diagnostics.

There have been reports of certain versions of Advanced IP Scanner being flagged by security software due to suspicious activities. It's advisable to download the software from the official website and ensure you're using a trusted version

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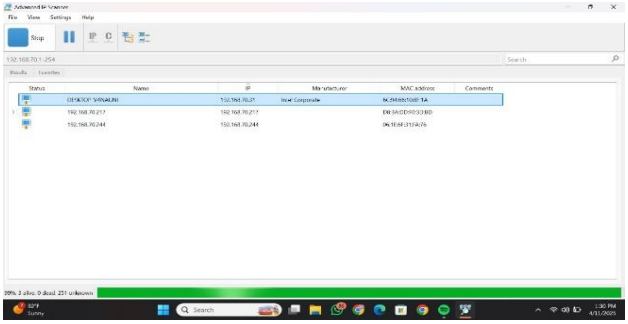

Figure 5: Advanced IP Scanner

Conclusion

The Adaptive Driver Vigilance Surveillance System represents a compact, real-time, and cost-effective approach to improving driver safety. By combining alcohol sensing, physical interaction detection, and visual fatigue analysis into one framework, it provides an intelligent way to prevent accidents before they happen.

Future enhancements could include:

-Deep learning-based eye detection for more accurate drowsiness tracking.

-Mobile app sync via Bluetooth or Wi-Fi for real-time reporting.

-Integration with vehicle braking system for emergency intervention.

The system is especially viable for countries where commercial ADAS are expensive or inaccessible

Reference

"Real-Time Driver's Drowsiness Monitoring Based on Dynamically Varying Threshold" Isha Gupta, Novesh Garg, Apoorva Aggarwal, Nitin Nepalia and Bindu Verma Department of Computer Science Engineering Jaypee Institute of Information Technology,Noida,IndiaEmail:bindu.verma@jiit.ac.in

"Drowsiness Detection Based On Driver Temporal Behavior Using a New Developed Dataset "F. Faraji,F. Lotfi, J. Khorramdel, A. Najafi, A. Ghaffari K. N. Toosi University of Technology,Tehran, Iran. arXiv:2104.00125v1 [cs.CV] 31 Mar 2021.

Dong, N., Li, Y., Gao, Z., Ip, W. H., & Yung, K. L.(2019). A WPCA-based method for detecting fatigue driving from EEGbased internet of vehicles system.IEEE Access,7,124702–124711. doi:10.1109/ACCESS.2019.2937914.

Balandong, R. P., Ahmad, R. F., Saad, M. N. M., & Malik, A. S. (2018). A review on EEG-based automatic sleepiness detection systems for driver. Ieee Access, 6,22908 22919.doi:10.1109/ACCESS.2018.2811723.

International Journal Of Engineering Applied Sciences And Technology, 2021 Vol. 6, Issue 4, ISSN No. 2455-2143, Pages 299-301 Published Online August 2021 In IJEAST "DRIVER DROWSINESS DETECTION USING PYTHON "Bhumika Rajput Department of Electrical Engineering Bundelkhand Institute of Engineering And Technology,Jhansi,India.

https://www.researchgate.net/publication/325100971 "Fatigue Detection Using Raspberry Pi 3 Article in International Journal of Engineering & Technology". April 2018 DOI:10.14419/ijet.v7i2.24.11993 Mandi Sushmanth Reedy,

Ezhilarasie R R, Kanimozhi Suguna. S.,Arumugam Umamakeswari.

Sikander, G., & Anwar, S. (2019). Driver Fatigue Detection Systems: A Review. IEEE Transactions on Intelligent Transportation Systems, 20(6), 2339–2352. doi:10.1109/TITS.2018.2868499.

Inalegwu, O. C., Maliki, D., Agajo, J., Ajao, L. A., & Abu, A. D. (2018). (2018). Fingerprint Based Driver'S Identification System. I-Manager's Journal onPattern Recognition, 5(2),30.doi:10.26634/jpr.5.2.15730.

Thanda Swe, K., & Kyaw, T. (2020). Fingerprint RFID Recognition System. International Journal of Creative and Innovative Research, 3(1), 21–25.

Kang, Z., & Yang, X. (2020). Fatigue Driving Characteristics Analysis Based on Data of Driver Monitoring System. CICTP 2020.doi:10.1061/9780784482933.370.

J Safety Res 2022 Feb;80:215-225. doi: 10.1016/j.jsr.2021.12.001.Epub 2021 Dec13." Physiological signal-based drowsiness detection using machine learning: Singular and hybrid signal approaches "Md Mahmudul Hasan, Christopher N Watling, Grégoire S Larue PMID: 35249601 DOI: 10.1016/j.jsr.2021.12.001.

IEEE"A Smartphone-Based Drowsiness Detection and Warning System for Automotive Drivers "Anirban Dasgupta ,Daleef Rahman, and Aurobinda Routray Publication: 28 December 2018 INSPEC Accession Number: 19132914 DOI: 10.1109/TITS.2018.2879609.

International Journal of Aquatic Science ISSN: 2008-8019 Vol 12, Issue 02, 2021 4297 "Real Time Driver Drowsiness Detection Using Opencv And Facial Landmarks" L.Thulasimani, Poojeevan P, Prithashasni S P Department of Electronics and Communication Engineering, PSG College of Technology Coimbatore – 641004.

International Journal of Advance Research, Ideas and Innovations in Technology 2019, www.IJARIIT.com All Rights Reserved Page |967 ISSN: 2454-132X Impact factor: 4.295 (Volume 5, Issue 2) Available online at: www.ijariit.com "Drowsiness detection with driver assistance for accident avoidance based systems" Vikas Chauhan, Sanjay Patel,Prudhvi Chowdary,Dharshen R. S.,Sai Siva Reddy,A. Mohammed Arif.

International Journal of Engineering Research & Technology (IJERT)ISSN: 22780181http://www.ijert.org IJERTV9IS090375 Published by: www.ijert.org Vol. 9 Issue 09, September-2020 "IoT based Alcohol and Driver Drowsiness Detection and Prevention System" Chaitanya V Shembekar, Priya Surana, Siddhesh More, Rushikesh Bhavthankar.